# THE PHYSICAL AND ECONOMIC DIMENSIONS OF MUNICIPAL SOLID WASTE MANAGEMENT IN ONTARIO

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# THE PHYSICAL AND ECONOMIC DIMENSIONS OF MUNICIPAL SOLID WASTE MANAGEMENT IN ONTARIO

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## ABSTRACT

The present study compiled information on the physical and economic dimensions of municipal solid waste management in Ontario. For the purposes of the study, the system was divided into three major components: waste generation, waste recycling, and waste disposal.

Waste generation was divided into two major generating sectors, namely: residential and industrial/commercial/institutional (ICI). Residential waste composition was estimated by combining information from a number of sources, including the recently completed study by Gore and Storrie. The study determined that the residential sector produced and estimated 3,901,900 tonnes of waste in 1987 and 4,053,200 tonnes in 1989. The major components of the residential waste stream are paper (36%) and organics (32%). The Blue Box program recycled approximately 97,000 tonnes (2% of the residential waste stream) in 1987 and 206,400 tonnes (5.1% of the residential waste stream) in 1989.

Industrial/Commercial/Institutional waste composition and generation rate information was obtained from a number of waste audits carried out in the Province. This information was divided into 25 ICI categories. Waste generation rates (kg/employee/day) and waste composition data (i.e. % wood, paper, etc.) were developed for each ICI category. This information was then combined with confidential county specific employment data to estimate the quantity and type of waste produced by each major ICI category in each county. The estimates were revised using actual county specific data, where available. Provincial totals calculated by this method were also revised using real data, where available.

The above method yielded an estimate of 5,189,000 and 5,361,000 tonnes of waste generated by the ICI sector in 1987 and 1989 respectively. Major waste categories included wood (1.3 million tonnes) paper products (1.221 million tonnes) and organics (0.6 million tonnes). The study identified 279,760 tonnes of ICI waste which was recycled in 1989. The actual figure is likely greater than this amount.

Waste generation rates in 1987 and 1989 are similar at approximately 420 kg/cap/year for residential waste, and 560 kg/cap/year for ICI waste.

# Section 1
# INTRODUCTION

## 1.1 BACKGROUND

In January 1990, the MOE Policy and Planning Branch awarded a contract to CH2M HILL ENGINEERING LTD. (with MacLaren Engineers as subcontractors) to develop a database on the Physical and Economic Dimensions of the Municipal Solid Waste Management System in Ontario. The study was carried out concurrently with three other studies to assess the socio-economic impacts of the waste diversion objectives announced on March 10, 1989. The objectives stated that 25% of the waste stream was to be diverted from landfill and incineration by 1992, and 50% was to be diverted by the year 2000. A base year of 1987 has been used for all of these objectives. The three other studies carried out concurrently, and the consultants awarded the contracts for these studies are as follows:

- Market Assessment of 3Rs Activities in Ontario (RIS & VHB)
- True Costs of Waste Management (VHB & MacLaren)
- Co-ordination and Synthesis (VHB & Econometric Research Ltd.)

## 1.2 STUDY OBJECTIVES

The objectives of this study were:

i) To develop a complete picture of municipal solid waste management in Ontario in 1987 and 1989.

ii) To use secondary data sources (i.e. published reports) to get information on sources and quantities of municipal solid waste; facilities for its handling and disposal; and, public, private and so-called third sector activities in solid waste management.

iii) To summarize information on the physical and economic dimensions of municipal solid waste management in this report and also in a database format amenable to updating as more information becomes available.

## 1.3 REPORT STRUCTURE

This report has been structured to provide the reader with a readily accessible reference document.

Section 2 outlines data sources used in the study. These include secondary sources available at the time the study (1990) and primary research through telephone calling, surveys etc.

The first task of the study was to develop waste quantity estimates for both the residential and the industrial/commercial/institutional (ICI) sector for 1987 and 1989. The methods used and the results obtained are summarized in Section 3. The amounts of recycled and disposed waste are also presented.

Together, Sections 4 and 5 develop as complete a picture as possible on all facets of the municipal solid waste management system in Ontario. Section 4 addresses the traditional elements of solid waste management including landfills, incinerators, transfer stations, haulers, and the environmental protection industry (EPI).

Section 5 describes recycling, including the status of municipal recycling programs, material recovery facilities (MRF's) and private, public and so-called third sector recycling agents (recyclers). Each of these topics is covered in four subsections: general description; physical dimensions; economic dimensions; and future trends.

Section 6 summarizes study results.

Appendix A contains a list of references. Appendix B contains a copy of the Dun and Bradstreet Survey commissioned as part of this study. Appendix C contains descriptions of available funding for recycling programs. Appendix D contains a description of the database developed as part of this project.

# Section 2
# DATA SOURCES

To complete a comprehensive database including all aspects of solid waste management in Ontario, an extensive review of waste management activities at the county level, and where available, at the municipality level, was required.

To fulfil these requirements, the study has been divided into two stages of data collection: the waste generation stage and the waste management system stage. Various components of the waste management system are presented in Figure 2.1 for easy reference. Data generated during the two stages were entered into dBASE files for presentation and manipulation. As the waste diversion objectives are being measured with 1987 as the base year (adjusted for population growth), waste quantity data (generation, disposal and recycling) in the database are for 1987 as well as for 1989, where available.

## 2.1 MUNICIPAL SOLID WASTE QUANTITIES

Information was obtained on the waste quantities produced in Ontario in 1987, as well as 1989. It was desirable for the study to obtain waste quantity data on a sector-specific basis. Generators were segregated into two sectoral classifications: the residential/light commercial sector, and the industrial/commercial/institutional (ICI) sector.

Those municipalities and regions for which Waste Management Master Plans (WMMP) had been prepared at the time of this study constitute approximately two-thirds of Ontario's population. Information for the remaining geographical areas not covered by the WMMPs was provided using residential generation rates derived from the Gore and Storrie Studies on residential waste in East York and Fergus.

Table 2.1 provides a list of the available WMMPs, all of which were reviewed and summarized as part of this study. WMMP documents do not contain all of the information necessary to adequately characterize the economic and physical dimensions of waste management. Extensive research identified a number of other sources which helped to fill the remaining information gaps following the review of the Waste Management Master Plans. A complete list of these secondary sources is summarized in matrix form in Table 2.2. The type of information obtained from each information source is noted in the table by a "X".

Residential and ICI waste generation information collected was disaggregated to the extent possible into fourteen specific waste types. To emphasize the potentially reclaimable materials, the complete list of waste types is derived from a prototype developed and used by Resource Integration Systems (RIS) in a related study. The RIS categories used throughout this study are presented in Table 2.3.

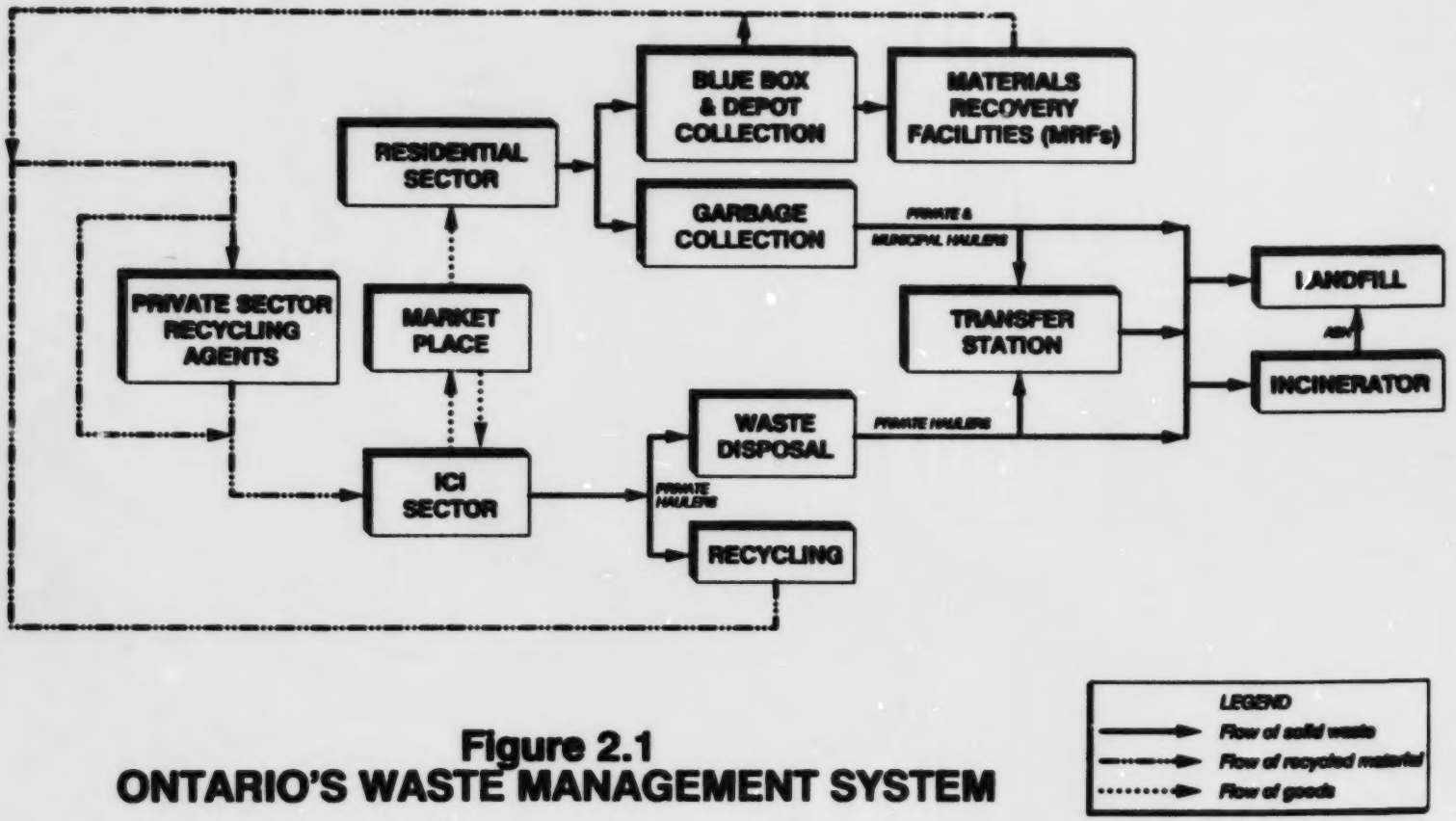



**Figure 2.1**
**ONTARIO'S WASTE MANAGEMENT SYSTEM**

## Table 2.1
## LIST OF WASTE MANAGEMENT MASTER PLANS (WMMP'S) REVIEWED DURING MSW DIMENSIONS STUDY

| County | Year Of Master Plan | Year of Data | County Served |
|---|---|---|---|
| Dufferin | 1989 | 1988 | Dufferin 100% |
| Easthope | 1985 | 1984 | Perth 12.95% |
| Essex | 1986 | 1984 | Essex 99.92% |
| Georgian Triangle | 1989 | 1988 | Simcoe 10.81%<br>Grey 1.94% |
| Grenville-Dundas | 1987 | 1986 | Leeds & Grenville 45.37%<br>Stormont-Glengarry 20.81% |
| Grimsby | 1989 | 1988 | Niagara 14.7% |
| Haldimand-Norfolk | 1984 | 1983 | Haldimand-Norfolk 100% |
| Centre & S. Hastings | 1987 | 1986 | Hastings 83.45% |
| Hawkesbury | 1986 | 1984 | Prescott-Russell 31.71% |
| Hearst | 1986 | n.d. | District of Cochrane 28.04% |
| Howland/Little Current | 1987 | 1986? | Manitoulin 32.6% |
| Huron | 1988 | 1987? | Huron 100% |
| Iroquois Falls | 1989 | 1988 | Cochrane 12.8 % |
| Kearney/Perry/ Mcmurrich | 1989 | 1988? | Parry Sound 9% |
| Kenora/Keewatin/ Jaffray-Melick | 1985 | 1985 | Kenora 42.68 % |
| Kingston | 1987 | 1985 | Frontenac 45.68 %<br>Lennox & Addington 33.66% |
| Niagara | 1982 | 1981 | Niagara Region 100 % |
| Northumberland | 1985 | 1984? | Northumberland 100 % |
| Ottawa-Carleton | 1985 | 1984 | Ottawa Region 100 % |
| Parry Sound | 1989 | 1988? | Parry Sound 46.06 %<br>Manitoulin 2.91% |
| Port Colborne/ Fort Erie | 1990 | 1989 | Niagara Region 11.33 % |
| South Simcoe | 1987 | 1986? | Simcoe County 20.98 % |
| Pembroke | 1988 | 1987 | Renfrew 47.45 % |
| Peterborough | 1988 | 1986 | n.d. |
| Sarnia-Lambton | 1986 | 1985 | Lambton 79.55 % |
| Smith Falls | 1987 | 1985 | Lanark 98.53 % |
| Stormont-Glengarry | 1988 | 1986 | Stormont-Glengarry 36.28 % |
| Victoria | 1989 | 1988 | Victoria 100 % |
| Waterloo | 1984 (revised) | 1982 | Waterloo Region 100 % |
| Wellington/Guelph<br>Sweep: Metro/ Durham/York | 1989<br>1988 | 1987<br>1987 | Wellington County 100 %<br>Metro/Durham/York |

## Table 2.2
## SECONDARY DATA SOURCES USED IN MSW DIMENSIONS STUDY

| Secondary Sources | Stage 1 - Waste Generation | | | | Stage 2 - Waste Management System | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Residential | Commercial | Industrial | Construction/ Demolition | Landfill | Transfer Station | Incineration | Haulers | Recyclers | Recycling Program |
| Waste Management Master Plans for 34 Municipalities and Regions in Ontario | X | X | X | X | X | X | X | X | X | X |
| Ministry of Municipal Affairs, 1989 Municipal Directory, 1989 | X | | | | | | | | | |
| Ministry of Treasury and Finance, Demographic Bulletin, 1989 | X | | | | | | | | | |
| Scotts Directory, Ontario Manufacturers 1988 - 1989 | | | X | | | | | | | |
| Standard Industrial Classification, Statistics Canada 1980 | | | X | | | | | | | |
| Employment, Earnings and Hours Report, Statistics Canada, 1989 | | X | X | | | | | | | |
| Ministry of Industry and Trade, Made in Ontario, 1985 | | | X | | | | | | | |
| Gore and Storrie, Waste Composition Study, 1990 | X | | | | | | | | | |
| Bird and Hale, 1978, Mun. Refuse Stats. For Canadian Communities over 100,000 | X | | | | | | | | | |
| Franklin and Associates, Municipal Solid Waste 1960-2000, 1986 & 1988 | X | | | | | | | | | |
| SWIAP, Discussion Paper 7.1: Towards A Solid Waste Master Plan, 1990 | X | X | X | | | | | | | |
| TRAC, Composition Analysis of Refuse By Land Use in the Core of Toronto, 1984 | X | X | | | | | | | | |
| SWISC, 3R Action Plan, 1990 | | | | | | | | | X | X |
| Santa Cruz, Santa Cruz Waste Composition Study, 1985 | X | X | | | | | | | | |
| OMMRI, Blue Box Distribution Inventory, 1989 | | | | | | | | | | X |

## Table 2.2
## SECONDARY DATA SOURCES USED IN MSW DIMENSIONS STUDY

| | Stage 1 - Waste Generation | | | | Stage 2 - Waste Management System | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Secondary Sources | Residential | Commercial | Industrial | Construction/ Demolition | Landfill | Transfer Station | Incineration | Haulers | Recyclers | Recycling Program |
| Toronto Home Builders Assoc., Making A Molehill Out of A Mountain, 1990 | | | | X | | | | | | |
| EPA, Summary of Data on Industrial Non-Haz. Waste Disposal Practices, 1985 | | | X | | | | | | | |
| City of Seattle, Waste Stream Composition Study 1988-1989, Vol. I&II | X | X | X | X | | | | | | |
| Windham Regional Commission, Solid Waste Planning Project, Phase I&II, | | | X | | | | | | | |
| VHB, Generic Waste Management Alternatives Study, 1988 | | | X | | | | | | | |
| MOE, Waste Disposal Site Inventory, 1988 | | | | | X | | | | | |
| Woods Gordon Mgt. Consultants, Ontario Environmental Protection Industry, 1989 | | | | | | | | | | |
| RECOUPS, Canadian Recyclers Directory 1987-1988 | | | | | | | | | X | |
| OWMA, 1990 Annual Directory, 1990 | | | | | X | X | | X | X | |
| RIS, Report on Multi-Material Source Separation Pilot Project in ICI, 1989 | | | | | | | | | X | |
| RCO, Markets List, 1989 | | | | | | | | | X | |

**Table 2.3**
**WASTE CATEGORIES TO BE USED THROUGHOUT MSW DIMENSIONS STUDY**

**Paper**
- Newspaper
- Fine paper
- Boxboard
- Corrugated cardboard (OCC)
- Magazines
- Mixed paper (waxed/plastic/mixed)
- Telephone books
- Composite packaging
- Other (kraft, wallpaper, tissue)

**Glass**
- Food and beverage containers
- Other

**Tinplate Steel**
- Food and beverage containers
- White goods
- Other

**Aluminum**
- Food and beverage containers
- Foil (rigid and flexible)
- Other

**Plastic**
- PET
- HDPE
- Other Rigid
- Film

**Organics**
- Food wastes
- Yard waste (leaves, grass, weeds)
- Yard waste (other)

**Wood Waste**
**Construction/Demolition Waste**
**Drywall**
**Other**
**Disposable Diapers**
**Used Tires**
**Household Hazardous Waste**
**Other**

Waste Management Master Plans were used as the primary source for compiling waste generation figures for the residential/light commercial sector. Waste quantity data for Metropolitan Toronto, York and Durham were obtained from a 1987 Solid Waste Environmental Assessment Plan (SWEAP) Metro document prepared by Metro Toronto.

For the industrial/commercial/institutional (ICI) sector, it was determined that a breakdown of waste sources into a 25 category system designed by Econometrics Research Ltd. was the most useful for the study. The industrial/commercial/institutional categories, referred to as Input Matrix Categories (IMC), used throughout the study are presented in Table 2.4.

Research activity revealed a number of industrial waste composition surveys and audits conducted internally by Ontario and U.S. municipalities. The data in these surveys was used to develop a waste composition database for the 25 IMC categories. The studies used originated from Essex-Windsor, Cornwall, Seattle, Washington, and Brattleboro, Vermont.

## 2.2 LANDFILLS

A database describing 730 landfill sites was developed using information obtained from Waste Management Master Plans, MOE Site Summary Reports, the MOE Inventory of Open and Operating Landfills, and results of a mail survey conducted by VHB Research Ltd. in association with MacLaren Engineers. It is estimated that this database covers greater than 90% of landfill capacity in the province. Many of the remaining landfills (approximately 670) serve northern municipalities of less than 1,000 people.

The primary sources of information on landfilling used in the preparation of this document were MOE Site Summary Reports. Where available, the information obtained from the reports includes data on the following items, although in some cases data for all items were not available:

- Certificate of Approval holder and address
- Site operator and address
- County
- Location
- Concession and lot number
- Name of municipality served and population
- Estimated remaining life
- Total annual tonnage received

**Table 2.4**

**AGGREGATION OF INDUSTRIAL/COMMERCIAL/INSTITUTIONAL ESTABLISHMENTS INTO 25 INPUT MATRIX CATEGORIES FOR MSW DIMENSIONS STUDY**

| Input Matrix Category (IMC) Number | Description | | Canadian 2 Digit Major SIC Categories Included |
|---|---|---|---|
| 1. | Agriculture: | agriculture | 01,02 |
| | | forestry | 04,05 |
| | | fishing, hunting and trapping | 03 |
| 2. | Mining: | metal mines | 06 |
| | | mineral fuels | 07 |
| | | non-metal mines | 08 |
| | | services incidental to mining | 09 |
| 3. | Food and Beverage Industries | | 10, 11 |
| 4. | Rubber, Plastic and Leather Industries | | 15 - 17 |
| 5. | Textile, Knitting Mills and Clothing Industries | | 18, 19, 24 |
| 6. | Wood Industries | | 25 |
| 7. | Furniture and Fixtures Industries | | 26 |
| 8. | Paper and Allied Industries | | 27 |
| 9. | Printing and Publishing Industries | | 28 |
| 10. | Primary Metal Industries | | 29 |
| 11. | Metal Fabricating Industries | | 30 |
| 12. | Machinery Industries | | 31 |
| 13. | Transportation Industries | | 32 |
| 14. | Electrical Products Industries | | 33 |
| 15. | Non-metallic Mineral Products Industries | | 35 |
| 16. | Chemical and Chemical Products Industries | | 37 |
| 17. | Miscellaneous Manufacturing Industries | | 39 |
| 18. | Other Major Manufacturing Industries: | | |
| | | tobacco products industries | 12 |
| | | petroleum and coal products industries | 36 |

**Table 2.4**

**AGGREGATION OF INDUSTRIAL/COMMERCIAL/INSTITUTIONAL ESTABLISHMENTS INTO 25 INPUT MATRIX CATEGORIES FOR MSW DIMENSIONS STUDY**

| Input Matrix Category (IMC) Number | Description | Canadian 2 Digit Major SIC Categories Included |
|---|---|---|
| 19. | Wholesale Trade Margins | 50 - 59 |
| 20. | Construction | 40 - 44 |
| 21. | Transportation Margins | 45 - 47 |
| 22. | Communications and Services: | |
| | communications | 48 |
| | owner occupied dwellings | |
| | finance, ins., and real estate | 70 - 76 |
| | education and health services | 85, 86 |
| | services to business management | 77 |
| | personal and misc. services | 97 |
| | amusement and recreation services | 96 |
| | accommodation and food services | 91, 92 |
| 23. | Electrical Power and Gas | 49 |
| 24. | Retail Trade Margins | 60 -65, 69 |
| 25. | *Other Sources: | |
| | operating office, lab, and food | 81 - 84 |
| | travel, promotion and advertising | 98, 99 |

---

* IMC 25 contains SICs not accounted for in other IMCs, namely:

| | | |
|---|---|---|
| SIC | 81 - | Federal Government Service Industries |
| SIC | 82 - | Provincial and Territorial Government Industries |
| SIC | 83 - | Local Government Service Industries |
| SIC | 84 - | International and Other Extraterritorial Government Service Industries |
| SIC | 98 - | Member Organization Industries |
| SIC | 99 - | Other Service Industries |

No Site Summary Reports were available for landfills located in the northeast and northwest regions of Ontario. It is estimated that there are greater than 700 small landfills in these areas serving small communities. The MOE Inventory of Open and Operating Landfills was consulted, however it did not provide additional information not found in the Site Summary Reports. Because there are such a large number of landfills in the northwestern and northeastern regions of the province, it was determined that only those serving a population of reasonable size would be placed in the database. A listing of landfills serving over 1,000 people was received from the MOE Northwestern Region office and the MOE Approvals Branch supplied a listing of landfills serving over 1,500 people for the Northeastern Region. Only location information was provided to the study team. This information was entered into the database. More information can be added as it becomes available.

Thirty-eight (38) Waste Management Master Plans were reviewed as part of this study. Some additional landfills not in the Site Summary Reports were identified and added to the database. The information on these landfills was also limited to location only.

Additional information for a number of the landfill sites was obtained from a survey carried out by VHB/MacLarens as part of a concurrent study and included:

- Remaining life
- Capital and operating costs
- Staff requirements
- Total annual tonnage received
- 1989 tipping fee

This information was added to landfill information provided by the Site Summary Reports, and supersedes all other data sources on landfills, since it is the most recently available information.

## 2.3 INCINERATORS

Only three incinerators in operation in Ontario receive MSW. The information on these incinerators was gained through direct telephone contact, since only one of the incinerators participated in the survey conducted by VHB/MacLarens in a concurrent study.

## 2.4 TRANSFER STATIONS

Information pertaining to location, capacity, source of wastes, final disposal location and pertinent economic data on transfer stations, where available, was compiled from Waste Management Master Plan data. A 1986 report to SWEAP by MacLarens provided additional information on Metro Toronto facilities. Employment data were

obtained directly through telephone contact with the Metro Public Works Department staff.

## 2.5 HAULERS

Waste haulers provide the necessary link that ties together the various components of the waste management system. Future decisions regarding waste management may have a significant impact on this industry. In order to understand the complexity and sensitivity of the industry to changes in waste management strategies, data identifying the key players were compiled, including:

- location
- regions served
- sectors served
- annual sales figures
- any other business activities
- employment
- amounts handled
- prices charged
- equipment used
- operating costs

These data were compiled from a combination of the results of a Dun and Bradstreet survey commissioned as part of this study and the OWMA (Ontario Waste Management Association) Members Directory.

## 2.6 RECYCLING PROGRAMS

Residential recycling has taken a prominent position among Ontario's traditional waste management strategies in recent years. Information pertaining to Ontario's municipal recycling programs (including curbside pick-up, depot collection, and fundraising events) was gathered from a number of sources in MOE, and also from an extensive survey carried out by RCO in 1987. Other useful information included the names of municipalities participating in the programs, the capital and operating costs for the programs, the types and quantities of materials collected through the programs and the revenue generated by the program.

Being a recent phenomenon, the level of data gathering and reporting has not kept pace with the level of recycling activity. Municipalities have concentrated on the start-up and maintenance activities associated with recycling and until recently, have had little time to develop data records. Consequently, documented records of recycled materials came from a variety of sources, some of which are more accessible than others.

A number of sources report on recycling activities in 1987 and/or 1989. Some are more limited in their usefulness than others. Each of these is described briefly below:

- Recycling Council of Ontario (1987) Municipal Source Separation Programs in Ontario.

  Over a period of three years, from 1985 to 1987, the RCO was assigned by the Ministry of the Environment to document the amount of Blue Box materials accumulated through the municipal recycling programs. Information is provided in disaggregated form for each material type and municipality operating a recycling program and was obtained through personal telephone interviews conducted with each program's recycling coordinator.

- Resource Integration Systems (1990) Market Assessment of 3R's Activity

  RIS, in conjunction with VHB, prepared a report on the recycling market's development in 1989 and the potential for future development. The report identified key materials targeted for diversion in municipal recycling programs. Markets were assessed by the quantity of materials recycled in 1989 and their ability to absorb more materials in the future.

- Ministry of the Environment (1989) Municipal Recycling Support Program

  In order for municipalities to receive capital and operating grants for the Blue Box program, the Ministry requires program operators to submit annual reports on the costs incurred and the amount of materials recycled at the end of the fiscal year. This policy has been in effect since the mid 1980s; however, the practice of producing accurate and reliable records has not. In the early years of the Blue Box program, municipalities did not have the mechanisms in place to keep up-to-date records of the quantities of materials being recycled. Data prior to 1989 have a great deal of uncertainty associated with them. Provincial totals are reported for 1989.

- Ministry of the Environment (1990) Closing the Loop - The 3Rs of Waste Management

  This publication lists a series of figures relating to the amount of material diverted by a single household Blue Box each year.

- OMMRI (1990) Databank

  OMMRI has produced, for public viewing, a document summarizing Blue Box and related activities in Ontario. The document summarizes the quantity of material collected in a single Blue Box each year.

## 2.7 MATERIAL RECOVERY FACILITIES

The initiation of curbside recycling in Ontario has necessitated start-up of sorting and processing facilities to prepare recycled materials for the private sector recycling agents and/or end users.

Data on these facilities were obtained from a survey conducted by VHB/MacLarens in a concurrent study. Information obtained included:

- employment
- capital and operating costs
- business activity (eg. manual sorting, mechanized sorting, etc.)
- source of waste (i.e. residential or ICI)
- materials handled
- municipality served

## 2.8 RECYCLING AGENTS (RECYCLERS)

One of the important players in the area of waste management, particularly in the area of waste diversion, is the recycling industry. The arrival of the "Blue Box" at the curbside triggers a sequence of responses which enables the materials to be collected, sorted, processed, marketed and remanufactured. The coordination of these activities reflects an extensive market infrastructure. To foster a greater understanding of the recycler's role and responsibility, this study focused on the following information:

- company name (including private or third sector collectors, brokers, dealers processors, end users)
- location
- staff and equipment requirements
- materials handled
- value of business
- municipalities served

The information was gained through the Recycling Council of Ontario and a survey by Dun and Bradstreet which was commissioned as part of this study.

## 2.9 DATA LIMITATIONS

The task of generating a comprehensive databank of waste management activities for the designated base year of 1987 has, from the beginning, set a number of limitations on the amount and accuracy of data retrievable.

Since the early 1980's, the Ministry of the Environment has encouraged municipalities to implement long-term waste management strategies. Since then, most municipalities have engaged in the process of developing Waste Management Master Plans. As indicated previously, one of the focal points of the secondary research had been the Waste Management Master Plans. Unfortunately, while waste management has assumed a high priority among municipal government activities during the late 1980's, it did not command a great deal of attention prior to that. Consequently, local governments are scrambling to understand the intricacies of their waste collection and disposal system. As a result, many of the figures cited in available reports (including WMMP's) represent estimates only, the reliability of which remains uncertain. This condition pervades most of the secondary sources of information citing 1987 figures. In fact, when locating a relevant secondary source, it is not uncommon to find information for the years subsequent to 1987 but not including 1987.

For this reason, data for 1989 were included in the study. These are considered more reliable, as improved record keeping efforts had been initiated in many areas by that time.

A similar situation exists with industrial/commercial/institutional waste composition data. This was of little interest to municipalities until the last year or two, but as landfill bans on some materials came into effect, it is obvious that very little information has ever been collected on the composition of ICI (industrial/commercial/institutional) waste disposed at landfills. A number of municipalities are initiating studies on waste composition at this time. The results will be available within a year but generally not in time to be used in the present study.

Despite the data limitations, the available data provides a working snapshot of the physical and economic aspects of Ontario's waste management system. The database developed for the purpose of the study can be updated in future as more accurate data become available.

# Section 3
# WASTE GENERATION AND DISPOSAL PATHWAYS

## 3.1 GENERAL

This section presents information on quantities and composition of residential and ICI (industrial/commercial/institutional) solid waste generated in Ontario. A discussion and summary of recycling in Ontario follows, along with available data on the amount and types of materials involved. Wherever possible, data are compared to alternative sources of information to substantiate their accuracy.

## 3.2 RESIDENTIAL SOLID WASTE

### 3.2.1 Composition Data

Numerous studies have estimated and/or measured residential solid waste composition in the last twenty years. This section briefly reviews those studies of major importance to Ontario. Section 3.2.2 compares the various data sources and presents a composition which is representative of residential solid waste generation in Ontario in 1987 and 1989.

**Gore and Storrie Ltd. in Association with Decima Research Ltd. 1990. Ontario Waste Composition Study. Reports to the Ontario Ministry of Environment,**

Gore and Storrie carried out large waste composition study for the MOE Waste Management Branch. As part of this study, residential waste composition studies were carried out in Fergus (population 6,757), East York (population 101,085) and North Bay (population 51,313). The results of the Fergus and East York studies were available to the CH2M HILL study team on a confidential basis for use in the present study.

The methodology used in the Gore and Storrie studies is as follows. Fergus and East York were divided into Enumeration Areas (EAs) containing 600 people in each, deemed to represent a range in socioeconomic status. Residential waste was collected from each of the 14 EAs (6 in Fergus, 8 in East York), twice per week for a five week period. The waste collection for the study was carried out in July and August 1989 in Fergus and in November and December 1989 in East York. The collection produced 10 samples of at least 100 kg each, for each EA. The sampling included both single and multiple family dwellings. Yard wastes were collected and weighed, but were not included in composition or generation rate calculations since their amounts vary on a seasonal basis. Blue Box Recycling programs are in place in each municipality and items from the Blue Box were tallied separately.

The method for estimating waste generation rates in the Gore and Storrie study involved collections of garbage separate from those used to estimate waste composition. Rather than using data on total weight of garbage collected for a given transfer station or landfill and dividing by the population served, total weight of collections from a small number of residences was divided by the estimated number of residents (approximately 25 to 30). This provided an estimate of generation rates before Blue Box items were removed from the waste stream.

**The Matrix Management Group 1989. Waste Stream Composition Study 1988-1989. Report to the City of Seattle, Department of Engineering, Solid Waste Utility.**

A total of 212 random samples were collected over a period of one year in an area of Seattle, Washington, (population 490,000) served by two transfer stations. Samples were collected for a full year, so as to accurately capture the production of yard wastes and other seasonally variable components. Information about waste composition (after recycling), and generation rates were collected at the transfer stations, and socio-economic data about the sample areas were provided by the waste haulers. As with the Gore and Storrie study, waste was collected from both single and multiple family dwellings.

**Franklin Associates Ltd., 1988. Characterization of Municipal Solid Waste in the United States 1960-2000, Report to the U.S. Environmental Protection Agency.**

A literature search was conducted to determine historical rates of production and consumption of goods in the United States, beginning in 1960. A "waste fates" computer model was used to estimate the composition of residential and light commercial waste, based on consumption figures. No direct sampling of waste was carried out for this study.

**Bird and Hale Limited, 1979. Municipal Refuse Statistics for Canadian Communities of over 100,000. Report to Environment Canada**

Residential and light commercial waste from Canadian cities with a population exceeding 100,000 was collected and analyzed in 1978.

**Evans, B and Paine, R.L., 1984. Composition Analysis of Refuse by Land Use in the Core of the City of Toronto. Report to the Toronto Recycling Action Committee (TRAC)**

Garbage was collected from seven sample areas (3 residential, 4 commercial), which were deemed to represent "typical" urban areas and to contribute significantly to the Municipal waste stream. The samples, which were comprised of at least 100 bags of

garbage each, were collected prior to 9:00 a.m. in late August of 1984. The sorting took place at the City of Toronto Public Works Yard. No municipal Blue Box recycling program was in place at the time of the study (1984).

### 3.2.2 Comparison of Residential Waste Composition Data Sources

Data from the Gore and Storrie studies were analyzed by CH2M HILL, in order to obtain overall residential waste composition values for Fergus and East York, both before and after recycling. This allowed some general comparisons with data from the other sources described above.

One of the difficulties in comparing the data from various studies is that each study uses its own set of waste stream component descriptions depending on which are of interest to the particular study. In addition, some studies report composition before recycling activity removes certain components from the waste stream, others afterwards. In an effort to compare these data sources, waste stream components from each study were regrouped as shown in Table 3.1. The resulting calculated compositions are presented in Table 3.2 for comparison.

The Bird and Hale, Metro Toronto (1984) and Franklin data should be compared to Gore and Storrie before recycling results. Seattle data which were collected after recycling can be compared to the Gore and Storrie after recycling results. However, it should be noted that because reported waste generation rates vary between the various studies, comparing reported percentages may also be of limited value. In spite of the various limitations the following observations are noteworthy:

- Reported food waste composition is 19.69% for Seattle, 26-27% for Fergus and East York before recycling and 31% for Fergus and East York after recycling. These may appear to be significant differences, but if the generation rate for food is calculated using total per capita waste generation figures shown in Table 3.2, Seattle generates 0.29 kg/cap/day of food waste, compared to 0.26 kg/cap/day for Fergus and East York.

- Franklin reports food waste to be a relatively small percentage of the waste stream (10.64%) whereas all other studies reported food wastes to be 19.69-31.91% of the waste stream.

- All of the studies report three components as significant percentages of the waste stream, namely
  - newspaper
  - mixed paper/magazines
  - food wastes

  The reported percentages vary significant between studies, as shown in Table 3.2.

## Table 3.1
## RE-GROUPING OF WASTE DESCRIPTIONS USED IN OTHER STUDIES INTO GENERAL WASTE CATEGORIES

| General Categories Used to Compare Study Results | Regrouping of Waste Descriptions Used in Other Studies | | | | |
|---|---|---|---|---|---|
| | Gore & Storrie | Bird & Hale | Franklin | Seattle | T.R.A.C. (Toronto) |
| Newspaper | Newsprint | Newsprint | Newspaper | Newspaper | Newsprint |
| Fine Paper | Fine Paper<br>CPO/Ledger | Fine | Office Paper | Office paper<br>Computer Paper | Fine |
| Boxboard | Boxboard | Not Reported | Not Reported | Not Reported | Brown Paper |
| OCC | OCC | Kraft | Corrugated Boxes | Corrugated Paper | OCC |
| Mixed Paper/ Magazines | Magazines/Flyers<br>Waxed/Plastic<br>Kraft<br>Wallpaper<br>Tissues | Other | Books/Magazines<br>Printed<br>Tissue/Towels<br>Other | Mixed Scrap<br>Other | Other |
| Glass | Glass (total) | Glass (total) | Glass (total) | Glass (total) | Glass |
| Packaging | Not Reported | Not Reported | other paperboard<br>Paper Pack.<br>Misc. Pack. | Not Reported | Not Reported |
| Aluminum | Non-Ferrous Metals(total) | Non-Ferrous Metals(total) | Aluminum (total) | Aluminum Cans<br>Containers<br>Non-Ferrous Metals | Non-Ferrous Metals |
| Tinplate Steel | Ferrous Metals(total) | Ferrous Metals(total) | Steel (total) | Tin<br>Bi-Metal Cans<br>Mixed/Ferrous | Ferrous Metals |
| White Goods | Not Reported | Not Reported | Appliances | White Goods | Not Reported |
| Rubber/Leather/ Textiles | Rubber/Leather/ Textiles | Rubber/Leather/ Textiles | Rubber Tires | Rubber Prods.<br>Tires | Not Reported |
| Yard Wastes | Yard Waste | Brush<br>Fines | Yard Wastes | Prunings<br>Leaves and Grass | Vegetation |
| Food Wastes | Food Waste/<br>Rodent Bedding | Putrescible | Food | Food | Food wastes |
| Wood Wastes | Wood | Lumber | Not Reported | Wood | Wood |
| Construction/ Demolition | Ceramics/Rubble<br>Fiberglass/<br>Gypsum Board/<br>Asbestos | Ceramics/<br>Rubble | Not Reported | Rocks/Concrete<br>Soil/Dirt/Fines<br>Gypsum/Drywall<br>Fiberglass<br>Debris | Not Reported |
| Diapers | Diapers | Not Reported | Not Reported | Diapers | Not reported |
| Household Hazardous Waste | Household<br>Hazardous<br>Waste | Petroleum<br>Chemical<br>Mix | Not Reported | Hazardous<br>Waste | Not reported |
| Other | Dry Cell<br>Batteries<br>Kitty Litter<br>Medical Waste | Not Reported | Clothing/footwear<br>Misc. Undurables<br>Misc. Inorganics<br>Furniture<br>Misc. Durables | Textiles<br>Leather<br>Ash<br>Porcelain/China | Textiles<br>Combust.<br>Non-<br>Combust. |

## Table 3.2
## COMPARISON OF WASTE COMPOSITION PERCENT AND GENERATION RATES FOUND IN OTHER STUDIES TO GORE AND STORRIE (1990) RESULTS

| Component | Bird & Hale 1979 (%) | Metro Toronto 1984 (%) | Franklin 1988 (%) | Seattle 1989 (%) | Gore & Storrie Before Recycling | | Gore & Storrie After Recycling | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Fergus (%) | East York (%) | Fergus (%) | East York (%) |
| Newspaper | 9.76 | 16.70 | 6.23 | 7.10 | 14.95 | 23.11 | 6.44 | 11.06 |
| Fine Paper | 8.27 | 1.00 | 4.87 | 0.30 | 1.99 | 1.82 | 2.35 | 2.26 |
| Boxboard | n.r. | 3.47 | n.r. | n.r. | 4.63 | 4.26 | 5.48 | 5.26 |
| OCC | 9.94 | 2.08 | 14.63 | 6.63 | 2.50 | 3.05 | 3.44 | 3.57 |
| Mixed Paper/Magazines | 12.68 | 20.67 | 14.95 | 22.18 | 10.60 | 12.15 | 13.00 | 15.02 |
| Glass | 6.80 | 7.05 | 9.39 | 7.74 | 9.29 | 6.88 | 5.77 | 4.43 |
| Plastic | 5.08 | 7.31 | 4.99 | 9.73 | 8.30 | 6.53 | 9.52 | 7.78 |
| Packaging | n.r. | n.r. | 5.68 | n.r. | n.r. | n.r. | n.r. | n.r. |
| Metals: non-ferrous | 0.85 | 0.14 | 0.87 | 1.23 | 1.31 | 0.99 | 0.98 | 0.97 |
| Tinplate Steel | 5.58 | 6.49 | 2.18 | 5.22 | 5.20 | 3.74 | 4.22 | 3.38 |
| White Goods | n.r. | n.r. | 4.62 | 0.04 | n.r. | n.r. | n.r. | n.r. |
| Rubber/Leather Textiles | 3.71 | n.r. | 1.41 | 3.73 | 3.92 | 4.11 | 4.64 | 5.08 |
| Food Waste | 31.62 | 22.24 | 10.64 | 19.69 | 26.70 | 25.81 | 31.59 | 31.91 |
| Wood Waste | 3.51 | 1.38 | n.r. | 1.59 | 1.39 | 0.94 | 1.64 | 1.16 |
| Construction/Demo. | 1.86 | n.r. | n.r. | 9.14 | 1.65 | 1.62 | 1.95 | 1.99 |
| Diapers | n.r. | n.r. | n.r. | 3.00 | 4.01 | 2.65 | 4.74 | 3.27 |
| Household Hazardous Waste | 0.32 | n.r. | n.r. | 0.68 | 0.40 | 0.41 | 0.48 | 0.49 |
| Other | 0.00 | 11.47 | 18.00 | 0.52 | 3.17 | 1.93 | 3.75 | 2.39 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Overall Waste Generation Rate kg/cap/day | - | - | - | 1.47 | 0.91 | 0.99 | - | - |

Notes:

* n.r. means that no waste was reported in that category.
- Yard wastes were not included in these calculations since Gore and Storrie did not report them. All other figures were adjusted accordingly.
- Franklin 1988 data includes light commercial waste as well as residential.

- There are some differences between Seattle data and the East York after recycling numbers. First, Seattle shows a high value for mixed paper and magazines composition (approximately 22% compared to East York 12%). Secondly, the reported construction and demolition materials (9% in Seattle, 2% in East York) are significantly different. A possible explanation is that the sampling in East York was done in the winter around Christmas time, which would decrease construction waste percentages, whereas Seattle gives an annual average, which may be more appropriate. However, differences in sorting strategies between the two studies may also play a role.

The range in values shown gives some indication of the variability associated with data from waste composition studies. It is important to recognize that although the final compositions arrived at for this study are reported to as many as four significant figures, the range in some of these figures may be quite significant.

The final residential waste composition values for 1987 and 1989 used for this study have been based largely on the Gore and Storrie data since this is the most recent study focused on sampling of the residential solid waste stream in Ontario. However, some of the numbers have been adjusted to account for factors not addressed in the Gore and Storrie methodology. For example, large items such as white goods were not collected in the Gore and Storrie study. The Gore and Storrie study eliminated items such as yard wastes which vary considerably on a seasonal basis. In addition, residential waste stream composition has changed slightly over the period 1987 to 1989 due to the introduction of aluminum beverage cans. Information from sources such as the other studies described above and information (made available to CH2M HILL by RIS who worked on a concurrent study) on production amounts were used to adjust the final compositions, as described in greater detail in Section 3.2.3.

Table 3.2 also presents reported residential waste generation rates from these studies which range from 0.91 to 1.47 kg/capita/day. Once again it is difficult to compare these figures since the various studies did not examine the same waste stream components. Further discussion of generation rates appears in Section 3.2.3.

Table 3.3 presents the final residential waste composition values used by the database to calculate amounts of various waste stream components produced by the residential sector in Ontario. The method used to arrive at these compositions is discussed in more detail in Section 3.2.3 since compositions were calculated when total provincial amounts of the various components were finalized.

Again, it must be pointed out that comparison to composition values presented in previous studies is limited by the fact that waste stream components are defined differently for each study. However, it is apparent that the composition values shown in Table 3.3 are in reasonable agreement with those presented in Table 3.2.

### 3.2.3 Residential Solid Waste Quantities

The task of developing residential solid waste generation rates for this study went through several iterations. The primary purpose of this subsection, then, is to summarize the final numbers arrived at, as well as to provide a brief history of the development of these figures referred to as the CH2M HILL initial estimate and the CH2M HILL final estimate in the following text. Any assumptions used in estimating quantities where actual data were unavailable are also outlined. A discussion of the accuracy of the data as well as comparison to other estimates concludes this subsection.

#### CH2M HILL Initial Estimate

An initial set of residential solid waste generation quantity estimates for 1987 were generated through the following approach. All available Waste Management Master Plans (WMMPs) were reviewed for data on per capita residential waste generation rates or total residential solid waste generation. This exercise yielded data for 52% of the province's population and 28% of all municipalities. All of these data were converted to per capita residential waste generation rates by applying the appropriate population for the year of the WMMP.

For the remainder of the municipalities, assumed generation rates based on the Gore and Storrie studies for Fergus and East York were applied. Thus it was possible to develop assumed generation rates which reflected differences for municipalities of greater than and less than 100,000 population, as well as for those conducting Blue Box recycling in 1987 and those who were not. Lower, "after-recycling" assumed generation rates were applied only for those counties where greater than 50% of single family homes were part of a Blue Box program in 1987. Since actual WMMP data were available for most of these communities, WMMP generation rates were applied.

The assumed generation rates as well as those developed from WMMP data were multiplied by 1987 population values to yield the estimates of 1987 residential waste quantities. This approach assumed that per capita generation rates remained constant from the time of the WMMPs to 1987. This assumption was considered reasonable since all WMMPs reviewed were published in the early- to late-1980s. Because the total quantities estimated by this method accounted for lower waste generation rates due to the presence of Blue Box programs, the resulting estimates reflected the amount of waste that was disposed (landfilled or incinerated) in 1987, rather than that which was actually generated. Because Blue Box recycling was not extensively implemented in Ontario in 1987, the quantity of waste generated by households would be similar to the quantity of waste disposed as the quantity of waste recycled by households was not a significant portion of the total waste stream. Using this method, it was estimated that 3,667,100 tonnes of MSW was disposed by households in Ontario in 1987. This estimate was subsequently revised as discussed in the next paragraph.

## Table 3.3
## ESTIMATED RESIDENTIAL WASTE COMPOSITION IN ONTARIO IN 1987 AND 1989

| Component | 1987 Composition (%) | 1989 Composition (%) |
|---|---|---|
| **PAPER** | | |
| Newsprint | 16.66 | 16.61 |
| Fine Paper | 1.83 | 1.83 |
| Boxboard | 4.29 | 4.27 |
| OCC | 2.70 | 2.69 |
| Magazines | 4.09 | 4.07 |
| Mixed Paper (waxed/plastic/mixed) | 1.47 | 1.46 |
| Phone Books | 0.32 | 0.32 |
| Composite Packaging | 0.28 | 0.28 |
| Other (kraft, wallpaper, tissue) | 4.85 | 4.84 |
| **Subtotal** | **36.49** | **36.37** |
| **GLASS** | | |
| Food/Beverage Containers | 6.65 | 6.62 |
| Other | 0.56 | 0.56 |
| **Subtotal** | **7.21** | **7.18** |
| **TINPLATE STEEL** | | |
| Food/Beverage Containers | 1.86 | 1.85 |
| White Goods | 2.51 | 2.50 |
| Other | 1.39 | 1.39 |
| **Subtotal** | **5.76** | **5.74** |
| **ALUMINUM** | | |
| Beverage Containers | 0.00 | 0.33 |
| Other Containers | 0.26 | 0.26 |
| Foil (rigid and flexible) | 0.07 | 0.07 |
| Other | 0.11 | 0.11 |
| **Subtotal** | **0.44** | **0.77** |
| **PLASTIC** | | |
| PET | 0.09 | 0.09 |
| HDPE | 0.28 | 0.28 |
| Other Rigid | 2.77 | 2.76 |
| Film | 3.09 | 3.08 |
| **Subtotal** | **6.24** | **6.22** |
| **ORGANICS** | | |
| Food Waste | 15.46 | 15.41 |
| Yard Waste (leaves, grass and weeds) | 12.12 | 12.08 |
| Yard Waste (other) | 4.08 | 4.07 |
| **Subtotal** | **31.66** | **31.56** |

**Table 3.3**
**ESTIMATED RESIDENTIAL WASTE COMPOSITION IN ONTARIO IN 1987 AND 1989 (Cont'd)**

| Component | 1987 Composition (%) | 1989 Composition (%) |
|---|---|---|
| WOOD WASTE | 1.16 | 1.15 |
| CONSTRUCTION AND DEMOLITION | | |
| Drywall | 0.28 | 0.28 |
| Other | 1.29 | 1.29 |
| Subtotal | 1.57 | 1.57 |
| DIAPERS | 2.75 | 2.74 |
| USED TIRES | 0.02 | 0.02 |
| HHW | 0.58 | 0.58 |
| OTHER | 6.13 | 6.10 |
| TOTAL | 100.00 | 100.00 |
| POPULATION | 9,271,500 | 9,598,600 |
| GENERATION RATE (kg/cap/year) | 421 | 422 |

Sources:

1. Gore and Storrie Ltd. in association with Decima Research Ltd., 1990. Ontario Waste Composition Study. Report to the Ontario Ministry of the Environment.

2. Apotheker, S., 1989. Recycling Pathways for White Goods. Published in Resource Recycling, October, 1989.

3. Personal Communication with Resource Integration Systems (RIS) on production values for specific materials.

4. See Table 3.5 for explanation of some sources.

## Table 3.4
## ESTIMATED RESIDENTIAL WASTE GENERATION BY MATERIAL TYPE IN ONTARIO IN 1987 AND 1989

| Component | 1987 Quantity (t/yr) | 1989 Quantity (t/yr) |
|---|---|---|
| **PAPER** | | |
| Newsprint | 650,200 | 673,200 |
| Fine Paper | 71,500 | 74,000 |
| Boxboard | 167,200 | 173,100 |
| OCC | 105,200 | 108,900 |
| Magazines | 159,500 | 165,100 |
| Mixed Paper (waxed/plastic/mixed) | 57,300 | 59,300 |
| Phone Books | 12,600 | 13,000 |
| Composite Packaging | 11,000 | 11,400 |
| Other (kraft, wallpaper, tissue) | 189,300 | 196,000 |
| Subtotal | 1,423,800 | 1,474,000 |
| **GLASS** | | |
| Food/Beverage Containers | 259,300 | 268,500 |
| Other | 21,900 | 22,700 |
| Subtotal | 281,200 | 291,200 |
| **TINPLATE STEEL** | | |
| Food/Beverage Containers | 72,500 | 75,100 |
| White Goods | 97,900 | 101,400 |
| Other | 54,400 | 56,300 |
| Subtotal | 224,800 | 232,800 |
| **ALUMINUM** | | |
| Beverage Containers | 0 | 13,500 |
| Other Containers | 10,000 | 10,400 |
| Foil (rigid and flexible) | 2,800 | 2,900 |
| Other | 4,200 | 4,300 |
| Subtotal | 17,000 | 31,100 |
| **PLASTIC** | | |
| PET | 3,700 | 3,800 |
| HDPE | 11,100 | 11,500 |
| Other Rigid | 108,100 | 111,900 |
| Film | 120,700 | 125,000 |
| Subtotal | 243,600 | 252,200 |

**Table 3.4**
**ESTIMATED RESIDENTIAL WASTE GENERATION BY MATERIAL TYPE IN ONTARIO IN 1987 AND 1989 (Cont'd)**

| | | |
|---|---|---|
| ORGANICS | | |
| Food Waste | 603,300 | 624,600 |
| Yard Waste (leaves, grass and weeds) | 472,800 | 489,500 |
| Yard Waste (other) | 159,300 | 164,900 |
| Subtotal | 1,235,400 | 1,279,000 |
| WOOD WASTE | 45,100 | 46,700 |
| CONSTRUCTION AND DEMOLITION | | |
| Drywall | 11,100 | 11,500 |
| Other | 50,300 | 52,100 |
| Subtotal | 61,400 | 63,600 |
| DIAPERS | 107,200 | 111,000 |
| USED TIRES | 800 | 800 |
| HHW | 22,600 | 23,400 |
| OTHER | 239,000 | 247,400 |
| TOTAL | 3,901,900 | 4,053,200 |
| POPULATION | 9,271,500 | 9,598,600 |
| GENERATION RATE (kg/cap/year) | 421 | 422 |

Sources:

1. Gore and Storrie Ltd. in association with Decima Research Ltd., 1990. Ontario Waste Composition Study. Report to the Ontario Ministry of the Environment.

2. Apotheker, S., 1989. Recycling Pathways for White Goods. Published in Resource Recycling, October, 1989.

3. Personal Communication with Resource Integration Systems (RIS) on production values for specific materials.

4. See Table 3.5 for explanation of some sources.

**CH2M HILL Final Estimate**

The scope of the study was subsequently expanded to include 1989 estimates of residential solid waste generation in addition to 1987 estimates. In addition, more data were obtained on quantities of various waste stream components generated in the Province (e.g. white goods etc.). It was also considered more appropriate to estimate the total amount of waste generated by the residential sector prior to recycling activities, and then subtract the quantities of waste recycled from this total to estimate the amount of residential waste disposed in the Province. This approach involved a simpler computational exercise for the study database. A number of adjustments were made to the provincial totals for some waste components. The 1989 totals were developed in conjunction with the work of RIS in a concurrent study. The final estimated residential solid waste quantities generated by households in Ontario in 1987 and 1989 are presented by component in Table 3.4. A summary of changes, assumptions and important comments by component appears in Table 3.5. As shown in Table 3.4 it is estimated that 3,901,900 tonnes of MSW was produced by the residential sector in Ontario in 1987 and 4,053,200 tonnes were produced in 1989.

Table 3.4 also presents population data and the resulting per capita generation rate for 1987 and 1989. This study has no data to suggest that the per capita generation rate is changing. The assumption of constant per capita generation for a particular area over time was made in the use of WMMP data as noted above. Thus the difference between 1987 and 1989 generation rates of less than half of one percentage point is considered insignificant. The generation rate of 422 kg/capita/year estimated for Ontario using the methods described above, will be used throughout this and other concurrent studies.

Data from the Ministry of the Environment's Waste Management Branch have suggested that the provincial residential solid waste generation rate is 400 kg/capita/year. However, no data have been provided to CH2M HILL to substantiate this figure. This study's figure of 422 kg/capita/year is slightly more than 5% higher, but because it has been based on extensive review of municipal data and, for some components, review of consumption data, it is believed to be the most comprehensive figure available. Within the accuracy of the study the two values (400 and 422 kg/cap/day year) are considered to be essentially the same.

Table 3.6 presents estimated residential solid waste generation in Ontario in 1987 and 1989 on a county-specific basis. Population, estimated total waste generated and per capita generation rates are presented for both reported years in the table. Where available, actual per capita generation rates were used. If no data were available, a default generation rate of 371 kg/cap/year is applied. This was estimated by substracting known county specific residential waste quantities and populations from provincial totals and dividing the remaining waste quantity by the remaining population. Per capita generation rates vary across the province, from a low of 228 kg/capita/year in Victoria County, to a high of 971 kg/capita/year in Niagara Region. No obvious reason for these wide ranges was identified during the present study.

## Table 3.5
## SUMMARY OF MODIFICATIONS TO RESIDENTIAL SOLID WASTE QUANTITY ESTIMATES

| Component | Basis Of Quantities (see notes) | Comments |
|---|---|---|
| Newsprint | a | |
| Fine Paper | a | |
| Boxboard | a | |
| OCC | a | |
| Magazines | a | |
| Mixed Paper | a | |
| Telephone Books | b | |
| Composite Packaging | a | This estimate a guess only; no data available. |
| Other Paper | a | |
| Glass Containers | a | The relative amounts in 1987 and 1989 of this item may not accurately reflect increasing displacement by plastic and aluminum since figures were adjusted by population only; no further data available. |
| Other Glass | a | |
| Tinplate Steel Containers | b | The relative amounts of this item for 1987 and 1989 may not accurately reflect increasing displacement by plastic and aluminum since figures were adjusted by population only; no further data available. |
| White Goods | c | |
| Other Tinplate Steel | a | |
| Aluminum Beverage Containers | d,e | This and following category created to bridge gap between RIS and CH2M HILL initial estimates. |
| Other Aluminum Containers | e | This and preceding category created to bridge gap between RIS and CH2M HILL initial estimates. |
| Aluminum Foil | f | |
| Other Aluminum | a | |
| PET | b | |
| HDPE | b | |
| Other Rigid Plastic | g | This and following category created to bridge gap between RIS and CH2M HILL initial estimates. |
| Film Plastic | g | This and preceding category created to bridge gap between RIS and CH2M HILL initial estimates. |
| Food Waste | b | |
| Yard Waste | h | |
| Other Yard Waste | h | |

## Table 3.5
## SUMMARY OF MODIFICATIONS TO RESIDENTIAL SOLID WASTE QUANTITY ESTIMATES

| Component | Basis Of Quantities (see notes) | Comments |
|---|---|---|
| Wood Waste | b | |
| Drywall | b | |
| Other Construction and Demolition Waste | a | |
| Diapers | b | |
| Used Tires | b | |
| Household Hazardous Waste | a | |
| Other | a | |

Notes:

a 1987 quantity from CH2M HILL initial estimate; 1989 quantity obtained by adjusting for population increase (3.53%).

b 1989 quantity from RIS initial estimate; 1987 quantity obtained by adjusting for lower population.

c Generation rate obtained from Apotheker, 1989. Recycling Pathways for White Goods. Published in Resource Recycling, October 1989. 1987 and 1989 quantities obtained by applying 1987 and 1989 population.

d 1987 quantity adjusted to zero since these items were not yet on the market; 1989 estimates from RIS.

e 1987 total of these two categories, from CH2M HILL initial estimates, scaled to 1989; 1989 Other Container total by difference with Beverage Container total from RIS (Note d); 1987 Other Container total from scaling of 1989 Other Container total.

f 1989 RIS quantity based on survey of production data; 1987 quantity obtained by adjusting for lower population.

g 1989 RIS quantity based on survey of Society of Plastics Industries; 1987 quantity obtained by adjusting for lower population.

h RIS initial estimate for these two categories divided according to the ratio of the 1987 CH2M HILL initial estimate; 1987 quantities obtained by adjusting for lower population.

**Table 3.6**

**ESTIMATED RESIDENTIAL POPULATIONS, GENERATION RATES AND WASTE QUANTITIES PRODUCED BY COUNTY IN ONTARIO, IN 1987 AND 1989**

| County | 1987 | | | 1989 | | |
|---|---|---|---|---|---|---|
| | Population | Generation Rate (kg/cap/yr) | Total Quantity (t/yr) | Population | Generation Rate (kg/cap/yr) | Total Quantity (t/yr) |
| Metro Toronto | 2,207,522 | 416 | 918,550 | 2,133,021 | 416 | 887,550 |
| Durham | 340,924 | 416 | 141,858 | 379,454 | 416 | 157,891 |
| Haldimand-Norfolk | 90,206 | 371 | 33,156 | 93,338 | 371 | 34,648 |
| Halton | 275,695 | 371 | 101,333 | 292,885 | 371 | 108,720 |
| Hamilton-Wentworth | 428,894 | 337 | 144,720 | 445,546 | 337 | 150,339 |
| Niagara | 371,173 | 971 | 360,372 | 384,450 | 971 | 373,262 |
| Ottawa | 618,785 | 354 | 219,081 | 661,795 | 354 | 234,309 |
| Peel | 613,941 | 473 | 290,531 | 676,702 | 473 | 320,231 |
| Sudbury (R.M.) | 149,856 | 371 | 55,080 | 152,308 | 371 | 56,537 |
| Waterloo | 335,520 | 416 | 139,610 | 357,810 | 416 | 148,885 |
| York | 374,225 | 416 | 155,715 | 445,044 | 416 | 185,183 |
| Muskoka | 40,950 | 371 | 15,051 | 43,713 | 371 | 16,226 |
| Brant | 106,636 | 371 | 39,195 | 110,776 | 371 | 41,121 |
| Bruce | 59,174 | 371 | 21,750 | 66,853 | 371 | 24,816 |
| Dufferin | 33,117 | 442 | 14,626 | 35,149 | 442 | 15,524 |
| Elgin | 70,326 | 371 | 25,849 | 72,767 | 371 | 27,011 |
| Essex | 319,023 | 371 | 117,259 | 334,347 | 371 | 124,111 |
| Frontenac | 115,930 | 301 | 34,656 | 119,169 | 301 | 35,856 |
| Grey | 74,812 | 372 | 27,547 | 77,407 | 372 | 28,779 |
| Haliburton | 12,044 | 371 | 4,427 | 12,437 | 371 | 4,617 |
| Hastings | 110,420 | 371 | 40,585 | 113,192 | 371 | 42,017 |
| Huron | 55,847 | 402 | 22,423 | 57,394 | 402 | 23,044 |
| Kent | 107,140 | 371 | 39,380 | 111,522 | 371 | 41,398 |
| Lambton | 125,128 | 371 | 45,991 | 127,983 | 371 | 47,508 |
| Lanark | 47,961 | 394 | 18,906 | 50,853 | 394 | 20,046 |
| Leeds & Grenville | 85,510 | 753 | 64,288 | 90,055 | 753 | 67,824 |
| Lennox & Addington | 47,099 | 332 | 15,504 | 48,460 | 332 | 16,084 |
| Middlesex | 337,078 | 371 | 123,895 | 355,340 | 371 | 131,904 |
| Northumberland | 68,242 | 420 | 28,645 | 71,590 | 420 | 30,050 |
| Oxford | 84,887 | 371 | 31,201 | 86,795 | 371 | 32,219 |
| Perth | 66,450 | 351 | 23,085 | 68,876 | 351 | 24,164 |
| Peterborough | 105,463 | 371 | 38,763 | 109,558 | 371 | 40,668 |
| Prescott-Russell | 59,074 | 371 | 21,713 | 63,745 | 371 | 23,662 |
| Prince Edward | 22,367 | 371 | 8,221 | 23,008 | 371 | 8,541 |
| Renfrew | 92,764 | 463 | 42,791 | 92,355 | 463 | 42,781 |
| Simcoe | 265,225 | 381 | 100,450 | 249,269 | 381 | 94,993 |
| Stormont-Glengarry | 103,371 | 685 | 71,215 | 100,369 | 685 | 68,753 |
| Victoria | 53,611 | 228 | 12,212 | 57,335 | 228 | 13,060 |

Table 3.6

**ESTIMATED RESIDENTIAL POPULATIONS, GENERATION RATES AND WASTE QUANTITIES PRODUCED BY COUNTY IN ONTARIO, IN 1987 AND 1989**

| | 1987 | | | 1989 | | |
|---|---|---|---|---|---|---|
| County | Population | Generation Rate (kg/cap/yr) | Total Quantity (t/yr) | Population | Generation Rate (kg/cap/yr) | Total Quantity (t/yr) |
| Wellington | 141,422 | 371 | 51,980 | 149,947 | 371 | 55,661 |
| Algoma | 132,179 | 371 | 48,583 | 135,960 | 371 | 50,469 |
| Cochrane | 94,207 | 371 | 34,626 | 99,608 | 371 | 36,975 |
| Kenora | 59,678 | 371 | 21,935 | 62,420 | 371 | 23,171 |
| Manitoulin | 10,308 | 371 | 3,789 | 10,519 | 371 | 3,905 |
| Nipissing | 78,799 | 371 | 28,963 | 80,896 | 371 | 30,029 |
| Parry Sound | 33,996 | 371 | 12,495 | 34,823 | 371 | 12,926 |
| Rainy River | 22,944 | 371 | 8,433 | 23,744 | 371 | 8,814 |
| Sudbury District | 25,393 | 371 | 9,333 | 25,428 | 371 | 9,439 |
| Thunder Bay | 156,206 | 371 | 57,414 | 161,954 | 371 | 60,118 |
| Timmiskaming | 39,973 | 371 | 14,692 | 40,626 | 371 | 15,081 |
| Total or Average | 9271500 | 421 | 3,901,900 | 9,598,600 | 422 | 4,053,200 |

Notes:

*Figures rounded in agreement with Table 3.4, and may not add exactly.

Where a value of 371 kg/cap/year appears, this is a default value used when actual data are not available.

## 3.3 INDUSTRIAL/COMMERCIAL/INSTITUTIONAL SOLID WASTE

### 3.3.1 Materials Excluded From Estimates

It is important to note that **several large volume ICI residuals** were not specifically considered in this study. These include solid wastes from:

- construction/demolition not disposed in public landfills
- decommissioning and clean-up of spills and contaminated soils
- road construction and maintenance
- dredging of waterbodies

In addition, the following materials were not considered in this study:

- foundry sand
- blast furnace slag
- fly ash
- bottom ash
- compost
- sewage sludge.

The focus of the present study was ICI waste that is disposed at non-hazardous waste landfills and incinerators. Waste composition data and waste quantity estimates are described in the following Sections.

### 3.3.2 Objectives of ICI Waste Generation Estimates

To be of maximum benefit to subsequent studies, the data generated by CH2M HILL on ICI waste had to include the following factors:

- ICI generation by waste type.
- ICI generation by industry (IMC) type.
- ICI generation by county.

It was determined that the best way to generate these estimates was to set up a model which took all of these factors into account. The following sections describe how the model was developed, and the preliminary data generated by the model. It should be stressed that the CH2M HILL/ERL model contains information available at the time of the study and that it can be updated as more information becomes available.

### 3.3.3 ICI Waste Composition Data

This study includes an ambitious effort to develop estimates of Industrial/Commercial/Institutional (ICI) solid waste generation in Ontario. As noted in Section 2, sources of data on ICI solid waste quantities and composition are scanty at best and so a method of estimation based on primary data collection, rather than secondary data sources was developed. It was determined that in order to meet the needs of concurrent economic studies, the estimation method would incorporate the economic sectors developed by ERL (Econometric Research Limited). The ERL model involves 25 sectors, known as Input Matrix Categories (IMCs), covering all SIC groups, as described in Table 3.7.

An **ICI waste composition database** was developed for this study primarily using data from surveying and auditing activities at 180 companies in the Essex-Windsor area. This was supplemented where necessary (i.e. where less than five data sets were available for a particular IMC) by data obtained from the City of Cornwall and in some cases from studies carried out in Seattle, Washington, and Brattleboro, Vermont. Data on employment and quantities of various waste components produced by each company were entered in the appropriate IMC waste composition file. IMC-specific average waste compositions and per employee generation rates were calculated from the data available. The results of this exercise (which went through a number of iterations described in Section 3.3.4) are presented in Table 3.8.

Several points regarding these data are worth noting. Data from four studies contributed to the IMC-specific data. This limits the coverage of some geographical and economic areas of the province. For example, data on IMC 2, Mining, were unavailable since the available survey data did not cover Northern Ontario. (In the case of IMC 2, Mining, this is not considered a serious limitation as the process itself does not generate quantities of material which are disposed at municipal landfills.)

For each IMC, the total amount of waste reported by all companies in the database was divided by the total number of employees reported for all the companies in the database to estimate an average per employee generation rate for the IMC. In some IMCs, data on a few firms appeared out of line with the remaining data. In many of these cases, some explanation could be found relating to the activities of the firm, and such outliers were deleted using professional judgement.

It should also be noted that while composition and generation rates for most IMCs were based on data from at least five firms, those firms did not necessarily represent the full range of activity in that sector. For example, data on IMC 1, Agriculture, are concentrated on greenhouses, rather than on farming or forestry activities. However, these data remain the most comprehensive available at the time of report preparation.

**Table 3.7**

**AGGREGATION OF INDUSTRIAL/COMMERCIAL/INSTITUTIONAL ACTIVITIES INTO 25 INPUT MATRIX CATEGORIES (IMC'S)**

| Input Matrix Category (IMC) Number | Description | | Canadian 2 Digit Major SIC Categories Included |
|---|---|---|---|
| 1. | Agriculture: | agriculture | 01,02 |
| | | forestry | 04,05 |
| | | fishing, hunting and trapping | 03 |
| 2. | Mining: | metal mines | 06 |
| | | mineral fuels | 07 |
| | | non-metal mines | 08 |
| | | services incidental to mining | 09 |
| 3. | Food and Beverage Industries | | 10, 11 |
| 4. | Rubber, Plastic and Leather Industries | | 15 - 17 |
| 5. | Textile, Knitting Mills and Clothing Industries | | 18, 19, 24 |
| 6. | Wood Industries | | 25 |
| 7. | Furniture and Fixtures Industries | | 26 |
| 8. | Paper and Allied Industries | | 27 |
| 9. | Printing and Publishing Industries | | 28 |
| 10. | Primary Metal Industries | | 29 |
| 11. | Metal Fabricating Industries | | 30 |
| 12. | Machinery Industries | | 31 |
| 13. | Transportation Industries | | 32 |
| 14. | Electrical Products Industries | | 33 |
| 15. | Non-metallic Mineral Products Industries | | 35 |
| 16. | Chemical and Chemical Products Industries | | 37 |
| 17. | Miscellaneous Manufacturing Industries | | 39 |
| 18. | Other Major Manufacturing Industries: | | |
| | | tobacco products industries | 12 |
| | | petroleum and coal products industries | 36 |
| 19. | Wholesale Trade Margins | | 50 - 59 |

**Table 3.7**
**AGGREGATION OF INDUSTRIAL/COMMERCIAL/INSTITUTIONAL ACTIVITIES INTO 25 INPUT MATRIX CATEGORIES (IMC'S)**

| Input Matrix Category (IMC) Number | Description | Canadian 2 Digit Major SIC Categories Included |
|---|---|---|
| 20. | Construction | 40 - 44 |
| 21. | Transportation Margins | 45 - 47 |
| 22. | Communications and Services: | |
| | communications | 48 |
| | owner occupied dwellings | |
| | finance, ins., and real estate | 70 - 76 |
| | education and health services | 85, 86 |
| | services to business management | 77 |
| | personal and misc. services | 97 |
| | amusement and recreation services | 96 |
| | accommodation and food services | 91, 92 |
| 23. | Electrical Power and Gas | 49 |
| 24. | Retail Trade Margins | 60 -65, 69 |
| 25. | *Other Sources: | |
| | operating office, lab, and food | 81 - 84 |
| | travel, promotion and advertising | 98, 99 |

---

* IMC 25 contains SICs not accounted for in other IMCs, namely:

| | | |
|---|---|---|
| IC | 81 - | Federal Government Service Industries |
| SIC | 82 - | Provincial and Territorial Government Industries |
| SIC | 83 - | Local Government Service Industries |
| SIC | 84 - | International and Other Extraterritorial Government Service Industries |
| SIC | 98 - | Member Organization Industries |
| SIC | 99 - | Other Service Industries |

## Table 3.8
## SUMMARY OF AVAILABLE INFORMATION ON WASTE COMPOSITION AND GENERATION RATES BY INDUSTRIAL SECTOR IN ONTARIO

| IMC Category | Reported Waste Composition (%) | | | | | | | | | | Generation Rates (kg/emp/day) | | Modified Median (a) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OCC | Office Paper | Other Paper | Wood | Glass | Plastic | Organics | Metal | Tires | Other | Median | Average | |
| 1 | 32.3 | 0.0 | 11.5 | 47.2 | 0 | 0 | 0 | 0 | 0 | 9.0 | 2.74 | 13.25 | 1.63 |
| 2 | n.d. | n.d | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d | n.d. | n.d. | n.d. |
| 3 | 4.4 | 0.8 | 3.7 | 2.0 | 8.6 | 2.0 | 60.6 | 5.1 | 0 | 12.8 | 11.96 | 15.41 | 14.98 |
| 4 | 9.6 | 0.7 | 1.4 | 18.1 | 0 | 18.8 | 0 | 5.8 | 31.4 | 14.3 | 4 | 7.22 | 7.15 |
| 5 | 1.0 | 0.4 | 18.1 | 1.7 | 0 | 8.8 | 0 | 1.3 | 0 | 68.8 | 1.62 | 1.69 | 1.66 |
| 6 | 3.5 | 0 | 0 | 65.8 | 0.1 | 5.7 | 0 | 1.5 | 0 | 23.4 | 4.48 | 4.72 | 4.4 |
| 7 | 6.7 | 0.8 | 0 | 15.2 | 0 | 0 | 0 | 6.0 | 0 | 71.3 | 2.51 | 9.63 | 8.45 |
| 8 | 6.5 | 13.2 | 0 | 39 | 0 | 0.2 | 13.4 | 20.8 | 0 | 6.8 | 5.25 | 5.50 | 5.13 |
| 9 | 1.8 | 5.1 | 81.8 | 2.7 | 0 | 0.2 | 0 | 0.2 | 0 | 8.2 | 1.19 | 2.02 | 1.95 |
| 10 | 5.6 | 0.1 | 17.3 | 52.0 | 0 | 0 | 0 | 1.6 | 0 | 23.4 | 2.86 | 15.07 | 5.84 |
| 11 | 4.6 | 0.1 | 11.5 | 11.7 | 0 | 1.1 | 0 | 48.5 | 0 | 22.5 | 2.83 | 6.52 | 5.94 |
| 12 | 5.4 | 0.2 | 1.3 | 11.4 | 0 | 3.5 | 2.7 | 23.9 | 0 | 51.6 | 1.37 | 3.53 | 3.21 |
| 13 | 4.7 | 0.5 | 1.4 | 12.0 | 0.4 | 0 | 0.2 | 29.3 | 0 | 51.4 | 2.35 | 6.53 | 5.95 |
| 14 | 12.3 | 2.6 | 33.2 | 38.8 | 0 | 4.1 | 0 | 7.5 | 0 | 1.5 | 4.48 | 3.97 | 3.16 |
| 15 | 1.7 | 4.0 | 0 | 3.5 | 0 | 0 | 0 | 65.4 | 0 | 25.4 | 6.83 | 7.74 | 7.47 |
| 16 | 47.7 | 1.6 | 11.4 | 1.4 | 3.0 | 8.9 | 0.2 | 5.0 | 0 | 20.7 | 3.90 | 6.57 | 3.29 |
| 17 | 18.5 | 0.7 | 31.4 | 6.5 | 1.2 | 0.8 | 0 | 21.0 | 0 | 19.8 | 1.64 | 1.33 | 0.96 |
| 18 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| 19 | 49.7 | 0 | 4.4 | 32.4 | 0 | 13.5 | 0 | 0 | 0 | 0 | 2.25 | 4.03 | 1.62 |
| 20 | 1.8 | 1.0 | 0 | 44.7 | 0 | 0.5 | 1.9 | 9.0 | 0 | 41.1 | (b) | 29.86 | 29 |
| 21 | 9.2 | 85.0 | 0 | 5.8 | 0 | 0 | 0 | 0 | 0 | 0 | 2.08 | 2.08 | 1.72 |
| 22 | 9.0 | 12.9 | 19.8 | 5.9 | 20.8 | 4.2 | 7.1 | 10.4 | 0.1 | 10.0 | 2.11 | 2.65 | 2.3 |
| 23 | 13.6 | 40.5 | 0 | 0 | 0 | 0 | 0 | 5.9 | 0 | 40.0 | 1.67 | 2.02 | 1.6 |
| 24 | 17.5 | 30.1 | 1.5 | 8.8 | 0.2 | 6.6 | 42.9 | 4.8 | 9.4 | 5.3 | 2.68 | 2.58 | 3 |
| 25 | 4.6 | 13.7 | 35.4 | 1.8 | 0.2 | 9.0 | 0.4 | 17.6 | 0 | 17.4 | 0.60 | 1.19 | 1.09 |

Notes:

Nd indicates no data available.

These compositions and generation rates were developed from raw data provided by studies in Essex-Windsor, (180 data sets) Cornwall, Seattle, Washington, and Brattleboro, Vermont, as noted in Section 3.3.1.

(a) Median and average values were calculated from original data. Modified median values were calcaulted when provincial estimates were revised.

(b) Average value not calculated for construction industry. Metro Toronto data used to calculate medians.

The waste categories for this database are the same as those used by Essex-Windsor, namely:

- OCC
- Fine paper
- Other paper
- Wood
- Glass
- Plastic
- Organics
- Metal
- Tires
- Clean Fill
- Garbage
- Other

Quantities of unsorted garbage (ie, waste components not identified) made up a large part of the data. This "garbage" quantity was redistributed in the various categories in proportion to the reported composition of the sorted waste stream. In addition, many of the components listed did not correspond to those of interest to this study. For example, metals were not differentiated by type. Unfortunately, this is a limitation of the available data. The category "Clean Fill" was deleted, because no data were reported.

The category "other" has been retained. The form of the raw data suggested that quantities in the "other" category were actually segregated, potentially recyclable items and not just "garbage". It was felt that this information, though limited, should not be discarded.

### 3.3.4 ICI Waste Quantity Estimates

Once per employee generation rates were developed for each IMC as described in the previous subsection, data on employment could be used to estimate total ICI waste produced in the province. This was accomplished by providing IMC employee generation rates to ERL, who used confidential provincial and county employment data to estimate ICI waste quantity production. The ICI estimate took place through a series of steps, described below.

The calculation was first performed on the provincial level in order to ascertain whether the method yielded reasonable figures. This involved a number of iterations to arrive at a reasonable provincial total quantity. When a reasonable provincial total was established, estimation of ICI waste generation on the county level took place. This permitted the comparison of estimates generated by the model to the limited data on total ICI quantities obtained from the review of Waste Management Master Plans (WMMPs). As noted in Section 3.3.1, per employee generation rates have a number of uncertainties associated with them, including: limited sampling of the range of activities

in some IMCs; deletion of outlying data points; and limited geographical area of sampling. Since those data available from WMMPs were likely more reliable, they were used to adjust model estimates in the database.

The means used to adjust the WMMP data for inclusion in the model are as follows:

1. The WMMPs did not always account for 100% of a county's population. WMMP ICI waste quantities were scaled proportionally to population to give estimates for the entire county.

2. Ten percent annual increases in ICI waste quantities were assumed to scale WMMP quantities from the year of the WMMP to 1987 and 1989. This assumption was considered reasonable, as the time period in question (mid to late 1980's) was one of economic prosperity.

In some cases, county-specific information on industrial sectors was used to adjust employee generation rates. For example, data on the construction sector in Metro Toronto was used to adjust generation rates for IMC 20.

Once the total ICI waste generation figure for each county was finalized (using either model or WMMP data), the Provincial total ICI waste quantity and total quantities, of material in each of the waste categories were re-calculated. For some waste quantities (specifically OCC, organics and tires), the calculated totals were adjusted using reported data from other sources. As an example, the ICI waste model calculated a total OCC value which was greater than the estimated quantity of OCC used in Ontario in 1989, as reported by RIS. In this case the CH2M HILL/ERL model values for generation by IMC group were adjusted to reflect the estimated Provincial OCC generation of 441,-000 tonnes.

A similar exercise was carried out for organics and used tires. The total quantity of organic waste produced by the ICI sector was estimated at 600,000 tonnes, based on data from a study of municipal solid waste generated in Seattle, Washington. The total quantity of used tries generated by the ICI sector was obtained from a study by Pilorusso. Waste generation rates and waste composition for each IMC were adjusted accordingly. The final adjusted waste generation rates and waste composition values used to estimate ICI waste generation in Ontario are presented in Table 3.8.

The method described above yielded an estimate of about 5,361,000 tonnes of ICI waste produced in the province in 1989. The final provincial ICI waste estimate for 1989 was used to provide a 1987 total using confidential employment data from ERL and the generation rates presented in Table 3.8. The two estimates do not take changes in waste generation and disposal practices between 1987 and 1989 into account.

The estimated breakdown of material types generated by the ICI sector in the province in both 1987 and 1989 are presented in Table 3.9. These data were generated by the CH2M HILL/ERL model with detailed industry specific waste generation and employment data. They are compared to independent estimates developed by RIS in a concurrent study in Section 3.3.5.

**Table 3.9**
**ESTIMATED ICI WASTE QUANTITIES GENERATED IN ONTARIO BY WASTE COMPONENT IN 1987 AND 1989 (CH2M HILL/ERL MODEL)**

| Component | Estimated Quantity Generated (tonnes) | |
|---|---|---|
| | 1987 | 1989 |
| OCC | 450,000 | 441,000 |
| Office Paper | 345,000 | 354,000 |
| Other Paper | 424,000 | 426,000 |
| Wood | 1,114,000 | 1,130,000 |
| Glass | 279,000 | 282,000 |
| Plastic | 167,000 | 163,000 |
| Organics | 568,000 | 600,000 |
| Metal | 558,000 | 599,000 |
| Tires | 82,000 | 88,000 |
| Other | 1,202,000 | 1,278,000 |
| **Total** | **5,189,000** | **5,361,000** |

Note: Total ICI waste quantities were developed by ERL Ltd. by multiplying the generation rates of Table 3.8 by employment data. Quantities of individual waste components were then calculated using the composition presented in Table 3.8

Table 3.10 presents ICI solid waste quantity estimates by county, and Table 3.11 presents estimated quantities generated by IMC. Note in Table 3.11 that some IMCs have been combined for 1987. Thus, direct comparison of 1987 and 1989 figures for these IMCs may be misleading. The affected IMCs are 19 and 24 (combined in 1987; separated for 1989) and IMC'S 21 and 23.

The MOE developed a preliminary estimate of 550 kg/capita/year for ICI waste generation. The per capita figures generated by various counties in the present study varied from a low of 206 kg/capita/year in Lennox and Addington in 1989, to a high of 699 kg/capita/year in Hamilton-Wentworth in 1987. It would appear reasonable that rates would vary across the province depending on the nature of economic activity in the various areas. Based on total ICI generation of about 5,189,000 tonnes and a provincial population of 9,271,500 in 1987, the overall provincial generation rate is estimated

## Table 3.10
## ESTIMATED ICI WASTE QUANTITIES GENERATED BY COUNTY IN ONTARIO, 1987 AND 1989

| County | 1987 | | | 1989 | | |
|---|---|---|---|---|---|---|
| | Quantity | Population | Gen. Rate (kg/cap/yr) | Quantity | Population | Gen. Rate (kg/cap/yr) |
| Algoma | 58,392 | 132,179 | 442 | 59,849 | 135,960 | 440 |
| Hastings/Prince Edward | 71,936 | 152,787 | 480 | 73,512 | 136,200 | 458 |
| Brant | 50,629 | 106,636 | 475 | 51,216 | 110,776 | 462 |
| Leeds & Grenville (Brockville) | 38,580 | 85,510 | 451 | 38,961 | 90,055 | 433 |
| Bruce | 25,416 | 59,174 | 430 | 26,123 | 66,853 | 391 |
| Northumberland (Cobourg) | 30,063 | 68,242 | 441 | 30,663 | 71,590 | 428 |
| Cochrane | 35,205 | 94,207 | 374 | 35,001 | 99,608 | 351 |
| Dufferin | 12,603 | 33,117 | 381 | 12,840 | 35,149 | 365 |
| Stormont-Glengarry (Dundas) | 52,721 | 103,371 | 510 | 53,953 | 100,369 | 538 |
| Elgin | 20,344 | 70,326 | 289 | 20,580 | 72,767 | 283 |
| Essex | 212,114 | 319,023 | 665 | 216,777 | 334,347 | 648 |
| Grey | 32,865 | 74,812 | 439 | 33,416 | 77,407 | 432 |
| Haldimand-Norfolk | 44,541 | 90,206 | 494 | 46,289 | 93,338 | 496 |
| Haliburton | 4,311 | 12,044 | 358 | 4,377 | 12,437 | 352 |
| Hamilton-Wentworth | 299,642 | 428,894 | 699 | 307,248 | 445,546 | 690 |
| Huron | 24,770 | 55,847 | 444 | 25,456 | 57,394 | 444 |
| Kenora & Rainy River | 25,964 | 82,622 | 314 | 25,898 | 86,164 | 301 |
| Kent | 59,356 | 107,140 | 554 | 61,380 | 111,522 | 550 |
| Frontenac (Kingston) | 77,480 | 115,930 | 668 | 77,780 | 119,169 | 653 |
| Lambton | 58,030 | 125,128 | 464 | 60,230 | 127,983 | 471 |
| Lanark | 19,072 | 47,961 | 398 | 19,485 | 50,853 | 383 |
| Lennox & Addington | 9,913 | 47,099 | 210 | 9,993 | 48,460 | 206 |
| Middlesex (London) | 196,574 | 337,078 | 583 | 199,382 | 355,340 | 561 |
| Manitoulin | 2,891 | 10,308 | 280 | 2,926 | 10,519 | 278 |
| Muskoka | 12,640 | 40,950 | 309 | 12,624 | 43,713 | 289 |
| Nipissing (North Bay) | 29,448 | 78,799 | 374 | 29,574 | 80,896 | 366 |
| Durham (Oshawa) | 143,820 | 340,924 | 422 | 191,671 | 379,454 | 505 |
| Ottawa-Carleton | 299,891 | 618,785 | 485 | 299,442 | 661,795 | 452 |
| Oxford | 40,365 | 84,887 | 476 | 41,299 | 86,795 | 476 |
| Parry Sound | 9,523 | 33,996 | 280 | 9,552 | 34,823 | 274 |
| Perth | 43,900 | 66,450 | 661 | 45,365 | 68,876 | 659 |
| Peterborough | 38,850 | 105,463 | 368 | 39,172 | 109,558 | 358 |
| Prescott-Russell | 18,309 | 59,074 | 310 | 18,550 | 63,745 | 291 |
| Renfrew | 31,754 | 92,764 | 342 | 32,151 | 92,355 | 348 |
| Simcoe | 95,327 | 265,225 | 359 | 96,556 | 249,269 | 387 |
| Niagara (St. Catharines) | 214,716 | 371,173 | 578 | 217,358 | 384,450 | 565 |
| Sudbury (R.M. & Dist.) | 82,049 | 175,249 | 468 | 82,853 | 177,736 | 466 |
| Thunder Bay | 74,121 | 156,206 | 475 | 73,942 | 161,954 | 457 |
| Timiskiming | 14,242 | 39,973 | 356 | 14,340 | 40,626 | 353 |
| G.T.A. (Metro, Halton, Peel, York) | 2,264,322 | 3,471,383 | 652 | 2,345,564 | 3,547,652 | 661 |
| Victoria | 21,781 | 53,611 | 406 | 22,160 | 57,335 | 387 |
| Waterloo | 221,364 | 335,520 | 660 | 225,123 | 357,810 | 629 |
| Wellington | 68,685 | 141,422 | 486 | 70,467 | 149,947 | 470 |
| Total | 5,188,519 | 9,271,495 | 560 | 5,361,098 | 9,598,595 | 559 |

Note:

ICI waste quantities by county were developed by ERL Ltd. by multiplying the employee generation rates of Table 3.8 by data on employment by county.

**Table 3.11**
**ESTIMATED ICI WASTE QUANTITIES GENERATED IN ONTARIO BY IMC CATEGORY IN 1987 AND 1989**

| IMC Category | Estimated Waste Generated (tonnes) | |
|---|---|---|
| | 1987 | 1989 |
| 1 | 62,000 | 75,000 |
| 2 | nd | nd |
| 3 | 440,000 | 468,000 |
| 4 | 135,000 | 135,000 |
| 5 | 35,000 | 38,000 |
| 6 | 27,000 | 25,000 |
| 7 | 73,000 | 74,000 |
| 8 | 80,000 | 80,000 |
| 9 | 38,000 | 42,000 |
| 10 | 130,000 | 139,000 |
| 11 | 148,000 | 171,000 |
| 12 | 50,000 | 49,000 |
| 13 | 250,000 | 255,000 |
| 14 | 82,000 | 81,000 |
| 15 | 60,000 | 59,000 |
| 16 | 66,000 | 61,000 |
| 17 | 30,000 | 34,000 |
| 18 | nd | nd |
| 19 | 169,000 | 166,000 |
| 20 | 1,487,000 | 1,601,000 |
| 21 | 139,000 | 134,000 |
| 22 | 1,140,000 | 1,155,000 |
| 23 | 33,000 | 28,000 |
| 24 | 417,000 | 397,000 |
| 25 | 97,000 | 94,000 |
| **Total** | **5,189,000** | **5,361,000** |

Notes:

1. "nd" indicates no data available
2. Estimates of ICI waste quantities by IMC were development by ERL Ltd. by multiplying the generation rates of Table 3.8 by employment in each IMC.
3. Totals are rounded to the nearest 1,000 tonnes.

at 560 kg/capita/year. For 1989, the average generation rate was calculated at 559 kg/capita/year. These values compare favourably to the MOE (1987) estimate of 550 kg/capita/year. It is not surprising that generation rates based on total population vary from year to year, since the size of the work force, and its distribution among IMCs is constantly changing. These estimates are based on a sound model of the relationship between economic activity and waste generation, as well as the best available data from surveys, and provide the detailed breakdowns by county, industry and waste type required to carry out the econometric analysis in concurrent studies.

**It should be stressed that this is the first time that an effort has been made to generate this type of information for Ontario and the estimates presented are subject to the limitations described throughout the text.** Many municipalities are now embarking on waste audits and waste composition studies. When the results of these studies are available, the CH2M HILL database can be updated and expanded and more accurate, up to date numbers can be developed. In the meantime, the estimate generated can be used for planning purposes.

### 3.3.5 Comparison of CH2M HILL/ERL Model Estimates with RIS Estimates

RIS developed estimates of various waste materials generated by the ICI sector as part of a concurrent study. These estimates are compared to the CH2M HILL/ERL model output in Table 3.12. The methodology used to develop the RIS estimates is outlined in *Market Assessment of 3R's Activities in Ontario, Report to MOE Policy and Planning Branch, 1991*. The total quantity of identified ICI waste in the RIS study was approximately 4,560,000 tonnes, based on 1989 data. The total waste which could be assigned to specific waste categories in the CH2M HILL/ERL model output was 4,083,000 tonnes, with or additional 1,278,000 tonnes in the "other" category. Direct comparison of the two estimates is limited by the fact that waste categories used in the two studies differ. The data provided by Essex Windsor had three paper products categories (OCC, fine paper, other paper) whereas the RIS study had seven (7) paper categories (old newspaper, fine paper, mixed paper, boxboard, OCC, magazines and telephones directories). The CH2M HILL/ERL model estimated a high generation rate for "metals" whereas RIS focused on data for two specific types of (recyclable) metal waste, namely tinplate steel cans and aluminum used beverage cans and foil.

The CH2M HILL/ERL model did not contain categories for drywall and foundry sand, both of which were included in the RIS study because of recyclability. The "other" category in the CH2M HILL/ERL estimate contains many of the materials estimated separately by RIS, and was retained in the model for this reason. The two sources provide a valuable first step in estimating ICI waste composition in Ontario.

## Table 3.12
## COMPARISON OF CH2M HILL/ERL AND RIS ICI WASTE QUANTITY ESTIMATES

| Material | CH2M HILL/ERL Estimate (tonnes) | RIS Estimate (tonnes) | RIS Reference Chapter | RIS Rationale |
|---|---|---|---|---|
| ONP | None | 206,700 | 3 | 3.48% of ICI waste stream (Seattle data). |
| Fine Paper | Different categories used. Office paper 354,000 tonnes, other paper 476,000 tonnes. | 510,800 | 4 | CPPA fine paper usage in Canada x 37%, subtract Residential to get ICI. |
| Mixed Paper | Category not used. Total for office paper and other paper = 780,000 tonnes | 513,300 | 5 | 8.64% of ICI waste stream (Seattle data) |
| Boxboard | Category not in CH2M HILL. May have been included in OCC estimates | 196,200 | 5 | 37% of CPPA figure for boxboard usage in Canada, less Residential usage. |
| OCC | 441,000 | 441,000 | 6 | CPPA, OCC usage for Canada x 37%. |
| Magazines | No category | 97,500 | 7 | Based on circulation of 195 m magazines @ 0.5 kg/magazine. |
| Telephone Directories | No category | 4,100 | 8 | Bell Canada total 17,200 tonnes minus Residential sector. |
| Plastics | 163,000 | 102,309 | 9 | RIS analysis, certain categories only. |
| Container Glass | 282,000 | 117,200 | 10 | 2.22% of ICI total (Seattle data). |
| Tinplate Steel Cans | No category-assume included in metals | 28,508 | 11 | 0.54% of ICI total (Seattle data). |
| Aluminum | No category-assume included in metals | 10,312 UBC<br>1,300 foil | 12 | Alcan data |
| Organics | 600,000 | 600,000 | 13 | Used CH2M HILL, based on Seattle data. |
| Disposal Diapers | No category | 8,000 | 14 | Pollution Probe gen. rate x 222 hospitals. |
| Wood Waste | 1,130,000 | 1,129,800 | 15 | Used CH2M HILL |
| Drywall | No category | 104,000 | 16 | Seattle (1.97% of ICI) |
| Scrap Tires | 88,200 | 88,200 | 17 | Inventory by Pilorusso |
| Foundry Sand | No category - not within the scope of this study | 400,000 | 18 | MITT |
| Other | 1,278,000 | No category | | CH2M HILL "other" category covers materials not described in detail elsewhere. |
| **Total** | **5,361,000** | **4,559,229** | | |

## 3.4 RESIDENTIAL WASTE RECYCLED

### 3.4.1 Background

Prior to the Blue Box program, residential recycling programs lacked structure and effectiveness in collection and processing of recyclable materials. Recycling programs were characterized by payback centres, operated by business entrepreneurs, and depots, operated by municipalities or non-profit organizations. Generally, opportunities to participate in recycling fluctuated with market demand for the material. As virgin materials entered periods of temporary short supply, manufacturing industries would turn to secondary materials as a means of augmenting material input demands. Rising prices for secondary materials provided individuals or groups with the impetus to start up local payback centres. Unfortunately, the instability of the supply and demand market for secondary resources transferred over to the recycling centres. When demand for secondary materials decreased, accompanied by declining prices, the payback centres would disappear. This situation played havoc with the recycling market and perpetuated the state of insecurity and instability.

Throughout the 1970s and the early 1980s, recycling programs were characterized as single-material programs featuring one of three collection techniques:

- Buy-Back Centres - These centres provide financial incentives for consumers to separate their recyclable wastes and sell them to recycling program operators. Program operators acted as middlemen, purchasing the recycled material from the consumer at a discounted rate and then selling the secondary materials to end-users for a higher price.

- Drop-off Centres - Depots work on the principal of participants bringing their recyclable wastes to an unmanned structure with separate compartments for the respective materials. Often these depots are dispersed in central locations throughout an urban area or at the landfill site or transfer station in rural areas.

- Curbside collection - Early initiatives focused on the occasional curbside collection of single materials, primarily old newspapers and yard waste.

For municipalities to embark on a full-scale curbside program, it was essential for the recycling markets to commit to a guaranteed pricing schedule and continued demand for secondary materials. In 1983, the City of Kitchener secured a commitment from Quebec and Ontario Paper Company to accept all of its recycled newspapers. Upon attainment of this commitment, a full-scale curbside recycling program was launched. Containers used to collect the recyclable materials consisted of blue plastic boxes - alias the Blue Box program.

Today, municipalities offer a multitude of recycling programs, ranging from curbside collection programs to depot programs. Programs are characterized according to the following classifications:

Class 1 - A multi-material curbside program involving the collection of at least newspaper, glass, and cans in an issued container with weekly collection usually on the same day as garbage day.

Class 2 - Multi-material collection on the same day as garbage day but not involving an issued container.

Class 3 - Curbside collection of newspaper only.

Class 4 - Depot collection of more than one material.

Class 5 - Depot collection of newspaper only.

In addition, municipalities have begun offering limited services to multi-unit residential buildings and rural areas. The majority of curbside recycling programs in operation target single family dwellings in urban environments.

In order to receive funding from the Ministry of the Environment and OMMRI, municipalities must ensure that the curbside collection program (Class 1) permits residents to recycle newspaper, glass, steel and aluminum. Although the collection of PET (polyethylene terephthalate) containers is optional, the majority of programs (with the exception of Ottawa/Carleton) offer collection.

As markets develop, programs can be expanded to include less traditional recyclable materials. Today, pilot projects are targeting magazines, boxboard, plastic film, and even disposable diapers. These and other trends will be further explored in Section 5.1.4 - Future Trends.

### 3.4.2 Data Manipulation

Recycling quantities generated in 1987 and 1989 were obtained from a variety of documents. Recycling numbers for 1987 were extracted from the RCO report and have been deemed highly accurate and therefore required minimal manipulation.

Failing to secure a comprehensive source for 1989 data, a combination of sources was used and a strategy was devised to determine the amount of Blue Box materials (newspaper, glass, steel, aluminum and PET) generated by each program operating in Ontario. In general, the amount of material recovered through each Blue Box was multiplied by the number of households served in each Blue Box program. OMMRI has produced a table of municipalities engaged in the Blue Box program from 1983 to the end of 1989. The total number of single-family households served by the curbside

program is calculated in the table. A comparison of sources helped to determine the amount of material recovered by each Blue Box, which is presented in Table 3.13. The variations in quantities reported for various materials are discussed below.

**Table 3.13**
**COMPARISON OF ESTIMATES OF MATERIAL RECOVERED PER BLUE BOX IN 1989**

| Material | MOE (kg/Blue Box/yr) | OMMRI (kg/Blue Box/yr) | RIS (kg/Blue Box/yr) | Calculated 1989 Blue Box Recovery Rate* (kg/Blue Box/yr) |
|---|---|---|---|---|
| Newspaper | 104.00 | 104.00 | 104.33 | 87.00 |
| Glass | 21.00 | 20.00 | 18.00 | 17.50 |
| Steel | 10.50 | 10.50 | 9.50 | 9.50 |
| Aluminum | -- | 0.90 | 2.04 | 1.80 |
| PET | 0.50 | 0.45 | 0.29 | 0.29 |

* The recovery rate was calculated by dividing the market number by the total number of blue boxes (1,792,000) used in Ontario as reported by OMMRI in 1989.

Sources: MOE Closing the Loop - the 3R's of Waste Management, 1990.
OMMRI Databank Information Sheets, March 1990.
RIS *Market Assessment of 3R's Activities in Ontario, 1991.*

## Newspapers

There is some variation in the reported quantity of newspaper recovered by households through the Blue Box program annually. Depending on the source, the reported figures range from a low of 87 kg/Blue Box/yr to 104 kg/Blue Box/yr. Both OMMRI and the Ministry of the Environment (MOE) cite the figure as 104 kg/Blue Box/year. However, RIS report that in 1989 the end user market collected 155,500 tonnes of old newspapers from municipal programs in Ontario. When divided by the number of households served by the Blue Box program in 1989 (1,792,000), the quantity recovered per Blue Box is estimated at 87 kg/Blue Box/yr. This estimate was used for the present study as the total tonnage of materials cited in the RIS report was acquired through personal communications with the newspaper recycling end users, which are considered the most reliable source for this data.

**Aluminum**

Documents have reported conflicting figures relating to the quantity of aluminium recovered by the Blue Box program on an annual basis. According to the RIS report, households discard 2.04 kg of aluminum material into their Blue Box annually. However, the aluminum market accepted 3,225 tonnes of aluminum in 1989, some of which originated from ICI recycling programs initiated by Alcan. Using the market number and applying it to the total number of households served by the Blue Box program in 1989, results in an estimated 1.8 kg of aluminum recovered per Blue Box per year. Since some of the materials have been sourced as coming from the ICI sector, the OMMRI cited number of 0.9 kg/Blue Box/yr appears most appropriate for use in the database developed as part of the present study.

**Glass, Steel, PET**

The quantities reported by the previously documented sources are in reasonable agreement with respect to the quantity of glass, tin and PET collected through each Blue Box on an annual basis. The numbers cited by OMMRI, MOE and RIS are within the following ranges:

- glass - 18-21 kg/Blue Box/yr;
- steel - 9.5-10.5 kg/Blue Box/yr; and
- PET - 0.29-0.50 kg/Blue Box yr.

To remain consistent with RIS, the numbers provided in the RIS report were chosen for use in the study database. RIS reports the quantities as: glass - 18 kg/Blue Box/yr, steel -9.5 kg/Blue Box/yr and PET - 0.29 kg/Blue Box/yr.

### 3.4.3 Quantities of Residential Waste Recycled

Table 3.14 summarizes the amount of recycled materials generated through the residential sector in Ontario in 1987 and 1989. The quantity of secondary materials recovered from the recycling program in 1987 amounted to 97,000 tonnes. These figures are based on the numbers recorded in the RCO report and as discussed previously, there is no reason to question their integrity.

In 1989, a total of 206,403 tonnes of recycled materials were collected through the Blue Box programs in Ontario (Municipal Recycling Support Program, MOE, 1989). The quantities calculated in the study database exceed the total amount reported in the MRSP program; the program reports the provincial total as 94,562 tonnes (refer to Table 3.15). The dichotomy between the two set of numbers can be explained by the fact that the MRSP program records only those figures reported by the municipalities. In 1989, a number of relevant contributors, namely Metropolitan Toronto, did not submit annual reports to the Ministry of the Environment. According to the SWISC

report, Metropolitan Toronto alone generated over 50,000 tonnes of secondary materials. This figure is not recorded in the 1989 MRSP report. Unfortunately, there is no dependable way to verify the numbers generated in the study database except to say that the provincial totals are based on the total amount of Blue Box materials reported by the end-user market.

Table 3.16 summarizes the study findings regarding residential solid waste recycling. The total quantity of residential solid waste generated in 1987 is estimated at 3,901,900 tonnes. The quantity of residential solid waste recycled in 1987 was reported as 97,000 tonnes by RCO (1987). Therefore, approximately 2.5% of the total residential solid waste stream was recycled in 1987. In 1989, total residential solid waste generation is estimated at 4,053,200 tonnes. An estimated 206,403 tonnes, or 5.1% of the residential waste stream was recycled. The net result is that an estimated 3,804,900 tonnes of residential solid waste was disposed in landfills/incinerators in 1987, and 3,846,800 tonnes was disposed in 1989.

## 3.5 ICI WASTE RECYCLED

### 3.5.1 Background

To date, much of the attention placed on recycling activities has been directed at the residential sector. With the Blue Box program securely in place, focus is being turned toward the ICI sectors (industrial, commercial, institutional).

The ICI sectors contribute large quantities of waste materials to Ontario's total solid waste stream. There exists enormous recycling potential since much of the waste stream is comprised of large volumes of recyclable materials which can be readily segregated. According to the Recycling Council of Ontario, corrugated cardboard represents 40% of the total waste materials generated by shopping malls and retail stores. Other materials such as fine paper and glass materials also contribute significant amounts to the solid waste stream generated by the ICI sector.

The ICI sector is being given a number of incentives to start incorporating 3R activities in their solid waste management strategies. In some cases, the driving force is legislative, for instance when municipal bylaws mandate landfill disposal bans on certain recyclable materials. In other cases, the driving force is economics in which savings are made through reduced tipping fee costs and sales of materials to secondary recycling markets.

Municipalities have begun targeting the ICI's most conspicuous wastes by imposing bans on specific materials entering landfills. Many larger municipalities, including Metropolitan Toronto, Peel, Halton and Durham, have introduced bans on corrugated cardboard, tires and wood wastes; and in some cases, have accepted responsibility for providing alternative markets for the materials. Table 3.17 identifies those bans placed on waste materials entering municipal landfills for the Greater Toronto Area.

## Table 3.14
## MATERIALS RECOVERED IN THE RESIDENTIAL SECTOR IN ONTARIO, 1987 AND 1989

| County | Municipality | Blue box | 1987 | | | | | 1989 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Newsprint | Glass | Tin | PET | Total | Newsprint | Glass | Tin | Aluminum | PET | Total |
| | | | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) |
| Metro | Toronto | 128300 | 5110 | 613 | 102 | | 5825 | 11162 | 2245 | 1219 | 115 | 36 | 14778 |
| | Etobicoke | 64000 | 3498 | 105 | | | 3603 | 5568 | 1120 | 608 | 58 | 18 | 7372 |
| | Scarborough | 111000 | 4378 | 10 | 83 | | 4471 | 9657 | 1943 | 1055 | 100 | 31 | 12785 |
| | North York | 92000 | 2935 | 34 | | | 2969 | 8004 | 1610 | 874 | 83 | 26 | 10597 |
| | York | 30000 | | 8 | 3 | | 11 | 2610 | 525 | 285 | 27 | 8 | 3455 |
| | East York | 22000 | 586 | | | | 586 | 1914 | 385 | 209 | 20 | 6 | 2534 |
| Durham | Oshawa | 34000 | 1953 | 23 | 8 | | 1984 | 2958 | 595 | 323 | 31 | 10 | 3916 |
| | Ajax | 14300 | 1348 | 237 | 79 | | 1664 | 1244 | 250 | 136 | 13 | 4 | 1647 |
| | Newcastle | 7000 | 586 | 24 | 11 | | 621 | 609 | 123 | 67 | 6 | 2 | 806 |
| | Pickering | 15000 | 736 | 53 | 5 | | 794 | 1305 | 263 | 143 | 14 | 4 | 1728 |
| | Whitby | 12500 | 603 | 24 | 13 | | 640 | 1088 | 219 | 119 | 11 | 4 | 1440 |
| | Brock | 3000 | | | | | 0 | 261 | 53 | 29 | 3 | 1 | 346 |
| | Scugog | 2500 | | | | | 0 | 218 | 44 | 24 | 2 | 1 | 288 |
| | Uxbridge | 1700 | | | | | 0 | 148 | 30 | 16 | 2 | 0 | 196 |
| Halton | Burlington | 29700 | 4267 | 359 | 97 | 2 | 4725 | 2584 | 520 | 282 | 27 | 8 | 3421 |
| | Halton Hills | 6800 | 420 | 106 | 20 | | 546 | 592 | 119 | 65 | 6 | 2 | 783 |
| | Milton | 6100 | 723 | 149 | 66 | | 938 | 531 | 107 | 58 | 5 | 2 | 703 |
| | Oakville | 27500 | 3089 | 386 | 70 | | 3545 | 2393 | 481 | 261 | 25 | 8 | 3167 |
| Hamilton/ | Hamilton | 81000 | 3996 | 517 | 228 | | 4741 | 7047 | 1418 | 770 | 73 | 23 | 9330 |
| Wentworth | Stoney Creek | 11600 | 962 | 123 | 56 | | 1141 | 1009 | 203 | 110 | 10 | 3 | 1336 |
| | Ancaster | 5160 | 481 | 58 | 29 | | 568 | 449 | 90 | 49 | 5 | 1 | 594 |
| | Dundas | 6000 | 503 | 65 | 28 | | 596 | 522 | 105 | 57 | 5 | 2 | 691 |
| | Flamborough | 3000 | | | | | 0 | 261 | 53 | 29 | 3 | 1 | 346 |
| | Glanbrook | 3100 | | | | | 0 | 270 | 54 | 29 | 3 | 1 | 357 |
| Niagara | Niagara Falls | 23800 | 1786 | 353 | 187 | | 2326 | 2071 | 417 | 226 | 21 | 7 | 2741 |
| | Port Colborne | 7000 | 29 | 5 | 4 | | 38 | 609 | 123 | 67 | 6 | 2 | 806 |
| | St Catharines | 39000 | 776 | | | | 776 | 3393 | 683 | 371 | 35 | 11 | 4492 |
| | Wooland | 15700 | 58 | 11 | 6 | | 75 | 1366 | 275 | 149 | 14 | 4 | 1808 |
| | Thorold | 7000 | 53 | 11 | 6 | | 70 | 609 | 123 | 67 | 6 | 2 | 806 |
| | Fort Erie | 11600 | | | | | 0 | 1009 | 203 | 110 | 10 | 3 | 1336 |
| | Grimsby | 5400 | 515 | 105 | 55 | | 675 | 470 | 95 | 51 | 5 | 2 | 622 |
| | Lincoln | 3000 | 284 | 59 | 37 | | 380 | 261 | 53 | 29 | 3 | 1 | 346 |
| | Niagara on the Lake | 5200 | | | | | 0 | 452 | 91 | 49 | 5 | 1 | 599 |
| | Pelham | 3500 | 327 | 67 | 35 | | 429 | 305 | 61 | 33 | 3 | 1 | 403 |
| | Wainfleet | 3000 | | | | | 0 | 261 | 53 | 29 | 3 | 1 | 346 |
| | West Lincoln | 1900 | 164 | 33 | 18 | | 215 | 165 | 33 | 18 | 2 | 1 | 219 |
| Ottawa | Ottawa | 78100 | 6165 | 2004 | 711 | | 8880 | 6795 | 1367 | 742 | 70 | 22 | 8996 |
| | Kanata | 10000 | 708 | 140 | | | 848 | 870 | 175 | 95 | 9 | 3 | 1152 |
| | Nepean | 26300 | | | | | 0 | 2288 | 460 | 250 | 24 | 7 | 3029 |
| | Gloucester | 24300 | | | | | 0 | 2114 | 425 | 231 | 22 | 7 | 2799 |
| | Cumberland | 12000 | | | | | 0 | 1044 | 210 | 114 | 11 | 3 | 1382 |
| | Osgoode | 4200 | | | | | 0 | 365 | 74 | 40 | 4 | 1 | 484 |

## Table 3.14 (Cont'd)
## MATERIALS RECOVERED IN THE RESIDENTIAL SECTOR IN ONTARIO, 1987 AND 1989

| County | Municipality | Bluebox | 1987 | | | | | 1989 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Newsprint | Glass | Tin | PET | Total | Newsprint | Glass | Tin | Aluminum | PET | Total |
| | | | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) |
| Peel | Brampton | 45600 | 2721 | 269 | 135 | | 3125 | 3967 | 798 | 433 | 41 | 13 | 5252 |
| | Mississauga | 98000 | 9825 | 1944 | 711 | | 12480 | 8526 | 1715 | 931 | 88 | 27 | 11288 |
| | Caledon | 10300 | 20 | | | | 20 | 896 | 180 | 98 | 9 | 3 | 1186 |
| Waterloo | Cambridge | 24500 | 1136 | 305 | 150 | | 1591 | 2132 | 429 | 233 | 22 | 7 | 2822 |
| | Kitchener | 35300 | 3821 | 817 | 391 | | 5029 | 3071 | 618 | 335 | 32 | 10 | 4066 |
| | Waterloo | 15300 | | | | | 0 | 1331 | 268 | 145 | 14 | 4 | 1762 |
| | Wilmot | 4300 | | | | | 0 | 374 | 75 | 41 | 4 | 1 | 495 |
| York | Markham | 40000 | 469 | 120 | 12 | | 601 | 3480 | 700 | 380 | 36 | 11 | 4607 |
| | Newmarket | 15000 | | | | | 0 | 1305 | 263 | 143 | 14 | 4 | 1728 |
| | Richmond Hill | 19000 | 963 | 97 | 16 | | 1076 | 1653 | 333 | 181 | 17 | 5 | 2188 |
| | Vaughan | 26000 | 27 | 8 | | | 35 | 2262 | 455 | 247 | 23 | 7 | 2995 |
| | Whitchurch-Stouffvil. | 5300 | 129 | 28 | 5 | | 162 | 461 | 93 | 50 | 5 | 1 | 610 |
| | East Gwillimbury | 5700 | | | | | 0 | 496 | 100 | 54 | 5 | 2 | 657 |
| | Georgina | 12500 | | | | | 0 | 1088 | 219 | 119 | 11 | 4 | 1440 |
| | King | 6400 | | | | | 0 | 557 | 112 | 61 | 6 | 2 | 737 |
| Muskoka | Bracebridge | 5400 | 294 | 70 | 33 | | 397 | 470 | 95 | 51 | 5 | 2 | 622 |
| | Gravenhurst | 4400 | | | | | 0 | 383 | 77 | 42 | 4 | 1 | 507 |
| | Huntsville | 6700 | | | | | 0 | 583 | 117 | 64 | 6 | 2 | 772 |
| | Georgian Bay | 2340 | | | | | 0 | 204 | 41 | 22 | 2 | 1 | 270 |
| | Muskoka Lakes | 6500 | 11 | 9 | | | 20 | 566 | 114 | 62 | 6 | 2 | 749 |
| Brant | Brantford | 25000 | | | | | 0 | 2175 | 438 | 238 | 23 | 7 | 2880 |
| | Paris | 2700 | | | | | 0 | 235 | 47 | 26 | 2 | 1 | 311 |
| | South Dumfries | 1450 | | | | | 0 | 126 | 25 | 14 | 1 | 0 | 167 |
| Bruce | Bruce Twp | 1200 | | | | | 0 | 104 | 21 | 11 | 1 | 0 | 138 |
| | Mildmay | 450 | | | | | 0 | 39 | 8 | 4 | 0 | 0 | 52 |
| | Elderslie Twp | 1700 | | | | | 0 | 148 | 30 | 16 | 2 | 0 | 196 |
| Dufferin | Orangeville | 5000 | | | | | 0 | 435 | 88 | 48 | 5 | 1 | 576 |
| | Shelburne | 1200 | | | | | 0 | 104 | 21 | 11 | 1 | 0 | 138 |
| | Mono | 2200 | | | | | 0 | 191 | 39 | 21 | 2 | 1 | 253 |
| Essex | Windsor | 85700 | 1741 | | | | 1741 | 7456 | 1500 | 814 | 77 | 24 | 9871 |
| | Amherstsberg | 2800 | 149 | 51 | 29 | | 229 | 244 | 49 | 27 | 3 | 1 | 323 |
| | Essex | 2000 | | | | | 0 | 174 | 35 | 19 | 2 | 1 | 230 |
| | Leamington | 4700 | | | | | 0 | 409 | 82 | 45 | 4 | 1 | 541 |
| | Tecumseh | 3000 | | | | | 0 | 261 | 53 | 29 | 3 | 1 | 346 |
| | Sandwich West | 4400 | | | | | 0 | 383 | 77 | 42 | 4 | 1 | 507 |
| Frontenac | Kingston | 13000 | | | | | 0 | 1131 | 228 | 124 | 12 | 4 | 1497 |
| | Kingston Twp | 10500 | | | | | 0 | 914 | 184 | 100 | 9 | 3 | 1209 |
| | Pittsburg | 2200 | | | | | 0 | 191 | 39 | 21 | 2 | 1 | 253 |
| Grey | Owen Sound | 6200 | 90 | | | | 90 | 539 | 109 | 59 | 6 | 2 | 714 |
| | Durham | 1200 | | | | | 0 | 104 | 21 | 11 | 1 | 0 | 138 |
| | Hanover | 2300 | | | | | 0 | 200 | 40 | 22 | 2 | 1 | 265 |
| | Neustadt | 200 | | | | | 0 | 17 | 4 | 2 | 0 | 0 | 23 |
| | Egremont Twp | 5600 | | | | | 0 | 487 | 98 | 53 | 5 | 2 | 645 |

## Table 3.14 (Cont'd)
## MATERIALS RECOVERED IN THE RESIDENTIAL SECTOR IN ONTARIO, 1987 AND 1989

| County | Municipality | Blue box | 1987 | | | | | 1989 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Newsprint | Glass | Tin | PET | Total | Newsprint | Glass | Tin | Aluminum | PET | Total |
| | | | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) |
| Huron | Howick | 700 | | | | | 0 | 61 | 12 | 7 | 1 | 0 | 81 |
| | Wingham | 1100 | | | | | 0 | 96 | 19 | 10 | 1 | 0 | 127 |
| | Grey Twp | 100 | | | | | 0 | 9 | 2 | 1 | 0 | 0 | 12 |
| Kent | Ridgetown | | 22 | | | | 22 | | | | | | 0 |
| Lambton | Sarnia | | | 21 | | | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Forest | 11100 | | | | | 0 | 966 | 194 | 105 | 10 | 3 | 1278 |
| Leeds & Grenville | Brockville | 6400 | | | | | 0 | 557 | 112 | 61 | 6 | 2 | 737 |
| Lennox & Addington | Ernestown | 3700 | | | | | 0 | 322 | 65 | 35 | 3 | 1 | 426 |
| Middlesex | London | | 3315 | | | | 3315 | 0 | 0 | 0 | 0 | 0 | 0 |
| | London Twp | 1400 | | | | | 0 | 122 | 25 | 13 | 1 | 0 | 161 |
| | Lobo | 1200 | | | | | 0 | 104 | 21 | 11 | 1 | 0 | 138 |
| | West Nissouri | 1000 | | | | | 0 | 87 | 18 | 10 | 1 | 0 | 115 |
| | North Dorchester | 2500 | | | | | 0 | 218 | 44 | 24 | 2 | 1 | 288 |
| Northumber-land | Campbellford | 1500 | | | | | 0 | 131 | 26 | 14 | 1 | 0 | 173 |
| | Cobourg | 3000 | 306 | 50 | | | 356 | 261 | 53 | 29 | 3 | 1 | 346 |
| | Port Hope | 2700 | 224 | 27 | 8 | | 259 | 235 | 47 | 26 | 2 | 1 | 311 |
| | Brighton | 1500 | | | | | 0 | 131 | 26 | 14 | 1 | 0 | 173 |
| | Colbourne | 800 | | | | | 0 | 70 | 14 | 8 | 1 | 0 | 92 |
| | Haldimand | 400 | 33 | 7 | | | 40 | 35 | 7 | 4 | 0 | 0 | 46 |
| | Hamilton | 1700 | 19 | 5 | | | 24 | 148 | 30 | 16 | 2 | 0 | 196 |
| | Hope | 500 | 34 | 7 | | | 41 | 44 | 9 | 5 | 0 | 0 | 58 |
| Oxford | Woodstock | | 502 | 141 | 37 | | 680 | | | | | | 0 |
| | Ingersoll | 2900 | | | | | 0 | 252 | 51 | 28 | 3 | 1 | 334 |
| | E. Zorra-Tavistock | 2200 | | | | | 0 | 191 | 39 | 21 | 2 | 1 | 253 |
| | S W Oxford | 2750 | 144 | 78 | 54 | | 276 | 239 | 48 | 26 | 2 | 1 | 317 |
| | Zorra | 2900 | | | | | 0 | 252 | 51 | 28 | 3 | 1 | 334 |
| Perth | Stratford | 7500 | 575 | 222 | 122 | | 919 | 653 | 131 | 71 | 7 | 2 | 864 |
| | St Mary's | 1800 | | | | | 0 | 157 | 32 | 17 | 2 | 1 | 207 |
| | Mitchell | 1200 | | | | | 0 | 104 | 21 | 11 | 1 | 0 | 138 |
| | Milverton | 500 | | | | | 0 | 44 | 9 | 5 | 0 | 0 | 58 |
| | North Easthope | 750 | | | | | 0 | 65 | 13 | 7 | 1 | 0 | 86 |
| | South Easthope | 750 | | | | | 0 | 65 | 13 | 7 | 1 | 0 | 86 |
| | Downie | 800 | | | | | 0 | 70 | 14 | 8 | 1 | 0 | 92 |
| | Hibbert | 150 | | | | | 0 | 13 | 3 | 1 | 0 | 0 | 17 |
| Peterborough | Peterborough | 21500 | 1671 | 326 | 129 | | 2126 | 1871 | 376 | 204 | 19 | 6 | 2476 |
| Renfrew | McNab | 1300 | | | | | 0 | 113 | 23 | 12 | 1 | 0 | 150 |
| Simcoe | Barrie | 15000 | 988 | 120 | 50 | | 1158 | 1305 | 263 | 143 | 14 | 4 | 1728 |
| | Alliston | 15050 | | | | | 0 | 1309 | 263 | 143 | 14 | 4 | 1733 |
| | Collingwood | 4000 | | | | | 0 | 348 | 70 | 38 | 4 | 1 | 461 |
| | Midland | 5000 | 98 | 38 | 22 | | 158 | 435 | 88 | 48 | 5 | 1 | 576 |

## Table 3.14 (Cont'd)
## MATERIALS RECOVERED IN THE RESIDENTIAL SECTOR IN ONTARIO, 1987 AND 1989

| County | Municipality | Blue box | 1987 | | | | | 1989 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Newsprint | Glass | Tin | PET | Total | Newsprint | Glass | Tin | Aluminum | PET | Total |
| | | | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) | (t/yr) |
| Simcoe | Penetanguishene | 2200 | 169 | 67 | 40 | | 276 | 191 | 39 | 21 | 2 | 1 | 253 |
| | Stayner | 1200 | | | | | 0 | 104 | 21 | 11 | 1 | 0 | 138 |
| | Wasaga | 5500 | | | | | 0 | 479 | 96 | 52 | 5 | 2 | 633 |
| | Adjala | | 31 | 13 | | | 44 | | | | | | |
| | Creemore | 500 | | | | | 0 | 44 | 9 | 5 | 0 | 0 | 58 |
| | Tottenham | | | 32 | 13 | | 45 | | | | | | |
| | Innisfil | 8200 | | | | | 0 | 713 | 144 | 78 | 7 | 2 | 944 |
| | Orillia | 8700 | | | | | 0 | 757 | 152 | 83 | 8 | 2 | 1002 |
| | Essa | 3500 | | | | | 0 | 305 | 61 | 33 | 3 | 1 | 403 |
| | Nottawasaga Twp | 500 | | | | | 0 | 44 | 9 | 5 | 0 | 0 | 58 |
| | Oro | 4000 | | | | | 0 | 348 | 70 | 38 | 4 | 1 | 461 |
| | Tay | 3500 | 22 | 8 | 4 | | 34 | 305 | 61 | 33 | 3 | 1 | 403 |
| | Tiny | 7400 | 22 | 9 | 5 | | 36 | 644 | 130 | 70 | 7 | 2 | 852 |
| | Elmvale | 700 | | | | | 0 | 61 | 12 | 7 | 1 | 0 | 81 |
| | Victoria Harbour | 600 | | | | | 0 | 52 | 11 | 6 | 1 | 0 | 69 |
| | Port McNicholl | 800 | 13 | 5 | 2 | | 20 | 70 | 14 | 8 | 1 | 0 | 92 |
| Stormont-Glengarry | Winchester | 700 | | | | | 0 | 61 | 12 | 7 | 1 | 0 | 81 |
| | | | | | | | 0 | | | | | | |
| Victoria | Lindsay | 5150 | | | | | 0 | 448 | 90 | 49 | 5 | 1 | 593 |
| | Fenelon Falls | | 18 | | | | 18 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wellington | Guelph | 22800 | 1499 | 408 | 128 | 34 | 2069 | 1984 | 399 | 217 | 21 | 6 | 2626 |
| | Fergus | 2450 | 150 | 43 | 18 | | 211 | 213 | 43 | 23 | 2 | 1 | 282 |
| | Mount Forest | | 3623 | | | | 3623 | | | | | | |
| | Elora | 1000 | | | | | 0 | 87 | 18 | 10 | 1 | 0 | 115 |
| | Erin | 800 | | | | | 0 | 70 | 14 | 8 | 1 | 0 | 92 |
| | Eramosa | 800 | | | | | 0 | 70 | 14 | 8 | 1 | 0 | 92 |
| | Erin Twp | 600 | | | | | 0 | 52 | 11 | 6 | 1 | 0 | 69 |
| | Maryborough | 6200 | | | | | 0 | 539 | 109 | 59 | 6 | 2 | 714 |
| | Nichol | 500 | | | | | 0 | 44 | 9 | 5 | 0 | 0 | 58 |
| | Peel Twp | 150 | | | | | 0 | 13 | 3 | 1 | 0 | 0 | 17 |
| | Puslinch | 1400 | | | | | 0 | 122 | 25 | 13 | 1 | 0 | 161 |
| | West Garafraxa | 300 | | | | | 0 | 26 | 5 | 3 | 0 | 0 | 35 |
| Kenora | Dryden | 3000 | | | | | 0 | 261 | 53 | 29 | 3 | 1 | 346 |
| | Subtotal | 1792000 | 81913 | 11027 | 4071 | 36 | 97047 | 155904 | 31360 | 17024 | 1613 | 502 | 206403 |
| | Provincial Total 1987 | 97047 | | | | | | | | | | | |
| | Provincial Total 1989 | 206403 | | | | | | | | | | | |

**Table 3.15**
**QUANTITIES OF RECYCLED MATERIALS REPORTED BY THE ONTARIO MUNICIPAL RECYCLING SUPPORT PROGRAM**

| Material | 1989 Total (Tonne) |
|---|---|
| Newspaper | 65242.36 |
| Glass | 18981.56 |
| Steel | 8765.13 |
| Aluminum | 1001.78 |
| PET | 571.96 |
| Provincial Total | 94562.79 |

Source: MOE, 1990 Municipal Recycling Support Program (handout).

**Table 3.16**
**SUMMARY OF RESIDENTIAL SOLID WASTE GENERATION AND RECYCLING DATA FOR ONTARIO 1987 AND 1989**

| | 1987 | 1989 |
|---|---|---|
| Residential solid waste quantity generated in Ontario (tonnes) | 3,901,900 | 4,053,200 |
| Residential waste recycled in Ontario (tonnes) | 97,000 | 206,400 |
| Percentage of residential waste recycled in Ontario | 2.5% | 5.1% |
| Quantity of residential waste disposed in landfills or incinerators (tonnes) | 3,804,900 | 3,846,800 |

* Estimates rounded off

- The Region of Peel, which has assumed a leadership position in the banning of ICI waste materials, advocates the need to provide alternative recovery sources for the materials. Applying this stewardship attitude, the Region has endorsed, and in some cases financially assisted, enterprising recycling and end-user companies.

- The City of Toronto offers diversion credits to commercial establishments for the recovery of corrugated cardboard from retail stores and glass containers from restaurants and taverns. These recycled materials are picked-up by the City and processed at appropriate recycling companies.

Table 3.17

MATERIALS BANNED FROM LANDFILLS AND MUNICIPAL COLLECTION IN THE GREATER TORONTO AREA

| County | Municipality | Tires | OCC | Dry Wall | Lumber | Leaves | White Goods | Fine paper | Constr/ Demo | Other |
|---|---|---|---|---|---|---|---|---|---|---|
| Durham | Region | Y | Y | P | N | Y | Y | N | N | |
| Halton | Region | >5Y | Y | Y | N | N | Y | N | N | Blue Box |
| Metro | Metro | Y | Y | P | N | Y | Y | N | N | |
| Peel | Region | Y | Y | Y | Y | N | N | N | N | |
| | Brampton | Y | Y | Y | Y | N | N | N | N | |
| | Mississauga | Y | Y | Y | Y | N | N | N | N | |
| | Caledon | Y | Y | Y | Y | N | N | N | N | |
| York | Georgina | N | N | Y | N | | N | N | Y | stumps,logs |
| | Markham | Y | Y | Y | N | Y | Y | N | Y | |
| | Newmarket | N | N | N | N | Y | Y | N | N | |
| | Vaughan | N | N | Y | N | Y | N | N | N | |
| | Whit-Stouffville | N | N | Y | N | Y | Y | N | N | |

Y = yes N = no P = potential

Reference: MacViro Consultants Inc. 3Rs Action Plan for SWISC, Toronto, Ontario April 1990.

Note: Generally regional governments are responsible for garbage disposal, hence regional policy affects local garbage collection.

In other cases, municipalities are taking a more proactive role in promoting waste reduction activities. In 1989, Toronto's City Council passed a bill requiring all new major developments to provide for waste reduction and recycling activities. Detailed waste reduction and recycling plans, to be submitted for approval by the Commissioner of Public Works, require a description of the expected waste stream composition as well as a description of the proposed waste reduction/recycling program. Provisions must be made for adequate storage and handling space for wastes being recycled, with attention paid to appropriate equipment and structural design needs.

Government grant programs also promote waste reduction and recycling programs in industry. In June 1987, the Ministry of the Environment announced its comprehensive funding program for waste management. The Industrial Waste Diversion Program provides industries with financial assistance in developing 4R strategies (reduce, reuse, recycle and recover). Industries are eligible for to up to 50% of the capital and start-up costs and up to 100% of the research and demonstration costs for 4R projects.

The program's progress to date was summarized as follows: (Closing the Loop, the 3Rs of Waste Management, MOE, 1990).

> "...more than 180 industrial 3Rs projects have been funded up to June 1990 with a potential to divert from disposal 73,000 tonnes of hazardous materials, 15.5 million litres of liquid wastes and 661,000 tonnes of industrial/commercial solid wastes".

The recycling market has begun to take advantage of funding programs and the opportunities available to capture ICI solid waste materials that are banned from landfills. In Ontario, a number of innovative businesses have begun to address the solid wastes produced by the ICI sector:

**Drywall**

- New Westminster Gypsum Company - Drywall is recycled using a process that separates the paper material from the gypsum materials then pulverizes the gypsum to be later used as a substitute for virgin material in the construction of new drywall. The company estimates that it can accommodate 85% of the construction industry's discarded clean drywall.

**Polystyrene**

- Canadian Polystyrene Recycling Association - CPRA has embarked on a program to recycle polystyrene generated by the ICI sector and fast food chains. The group is currently in the process of building a recycling facility. Polystyrene will be palletized and used in the manufacturing of

low grade plastic products, such as blue boxes, snow fences, and drainage pipes.

**Textiles**

- H&I Carpets - In association with other carpet manufacturers, this company is aggressively attacking the issue of carpet recycling. Efforts are underway to develop a method to effectively separate the backing from the fibre part of the carpet. H&I Carpets are working closely with ORTECH to resolve the separation problem.

**Tires**

- Viceroy-Trent Group - A technology has been developed to reduce tire rubber into crumb rubber to be used as a material input in the manufacturing of shoe soles, rubber hoses, garbage cans, composters, blue boxes, door mats, car mats, etc. The company will use this technology in its tire recycling facility, which will have a capacity of 9 million tires recycled/year at the end of five years.

**Wood Waste**

- WCI Waste Conversion Inc. - Launched in November 1989, this company has initiated a wood waste pilot project to research and develop new end uses for a number of wood wastes that cannot be currently recycled such as plywood, particle board and other building materials, railway ties, compost, and fire logs.

### 3.5.2 Data Availability and Limitations

Despite the recent endeavour to divert ICI wastes from landfills, relatively little recording activity has taken place. As occurred in the early stages of the Blue Box program, recycling program coordinators have focused their energies on the implementation of recycling programs, leaving data collection and recording for later.

Two sources have produced preliminary figures relating to ICI recycling programs.

- Solid Waste Interim Steering Committee, 3Rs Action Plan

Part of the Greater Toronto Area (GTA) management system, the SWISC committee published a report outlining current 3R initiatives in the five regions comprising the GTA (Metropolitan Toronto, Peel, Halton, Durham and York). Recycling figures for the ICI sectors are reported, where available, in the document.

- Resource Integration Systems, Market Assessment of 3R's Activities

  RIS, in conjunction with VHB, has prepared a report on the recycling market's development in 1989 and the potential for future development. The report identifies key materials targeted for diversion in municipal recycling programs. Markets were assessed by the quantity of materials recycled in 1989 and their ability to absorb more materials in the future.

The RIS report has produced estimates of ICI recycling rates using a variety of sources and methodologies. For some materials, RIS acknowledges that information is not available. The available numbers are summarized in Table 3.18.

In addition, the SWISC report provides useful but limited data on the diversion of ICI waste materials through recycling programs. These figures are provided in Table 3.19.

At present, the ICI sector appears to be having difficulty quantifying the amount of solid waste materials generated on site. Until industries, commercial businesses and institutions can determine the types and amounts of solid waste being generated, there is little hope for companies to formulate comprehensive waste diversion data. However, as the current rate of recycling activity in the ICI sector increases, more emphasis will be placed on collecting and recording the quantities of materials recycled.

**Table 3.18**
**ESTIMATED QUANTITIES OF MATERIAL RECYCLED BY THE ICI SECTOR IN 1989 (TONNES)**

| Component | Estimated Quantity Recycled in 1989 |
|---|---|
| Old Newsprint (ONP) | 0 |
| Fine Paper | 30,000 |
| Mixed Paper | 0 |
| Boxboard | 0 |
| Corrugated Cardboard | 110,300 |
| Magazines | 0 |
| Telephone Directories | 0 |
| Plastics | 0 |
| Container Glass | 5,800 |
| Tinplate Steel Cans | 60 |
| Aluminum | 100 |
| Food Waste | 30,000 |
| Disposal Diapers | 400 |
| Wood Waste | 96,000 |
| Drywall | 1,000 |
| Scrap Tires | 6,000 |
| Total | 279,760 |

Source: RIS *Market Assessment of 3R's Activities in Ontario 1991* Table 19.1

**Table 3.19**
**ESTIMATED QUANTITIES OF ICI WASTE RECYCLED IN THE GREATER TORONTO AREA**

| Component | Quantity Reported |
|---|---|
| OCC | 93,000 |
| Fine Paper | 6,800 |
| Plate Glass | 2 |
| Container Glass | 15 |
| Tires | 2,300 |
| Oils | 0 |
| Solvents | 0 |
| Drums | 0 |
| Metal | 5 |
| Plastic | 350 |
| Rubber | 0 |
| Textiles | 30 |
| Other 1 | 2,550 |
| Other 2 | 18,000 |
| Total | 123,052 |

Source: SWISC, 1990

# Section 4
# PHYSICAL AND ECONOMIC DIMENSIONS OF THE WASTE MANAGEMENT SYSTEM

## 4.1 GENERAL DESCRIPTION OF THE SYSTEM

One of the objectives of the study was to follow the waste stream from the point of generation to the point of disposal or end-use. Where possible, this study identifies the waste handling and management methods used by the counties and municipalities in Ontario and provides a review of the relevant players involved in the waste management activities. However, adequate data are not available to directly link specific generators of waste with specific receivers of waste.

Figure 4.1 has been developed to introduce the reader to the configuration of the waste management system in Ontario, as well as to the terminology used throughout this text. Some minor material flow paths have been excluded from the figure. Where available, estimated quantities have been added to flow paths.

This Section has been developed to describe haulage and disposal pathways, while Section 5 addresses recycling of waste materials. Information on the following components of the waste management system is discussed in this Section:

- landfills
- incinerators
- transfer stations
- haulers

## 4.2 LANDFILLS

### 4.2.1 General Description

Landfilling is the most common method of waste management used in Ontario. A landfill is typically developed or filled in cells. Each cell is excavated, filled with garbage, which is compacted and covered with clean material. Garbage is disposed in one small area of a landfill at any given time. This is referred to as the "working face". The area being filled is covered at the end of the day to prevent the nuisance of windblown garbage to surrounding areas. When completed, the landfill surface is shaped to finished contours. Modern landfill design is carried out under design and operation standards which mitigate environmental hazards. This involves consideration of a number of factors, as discussed below and illustrated in Figure 4.2.

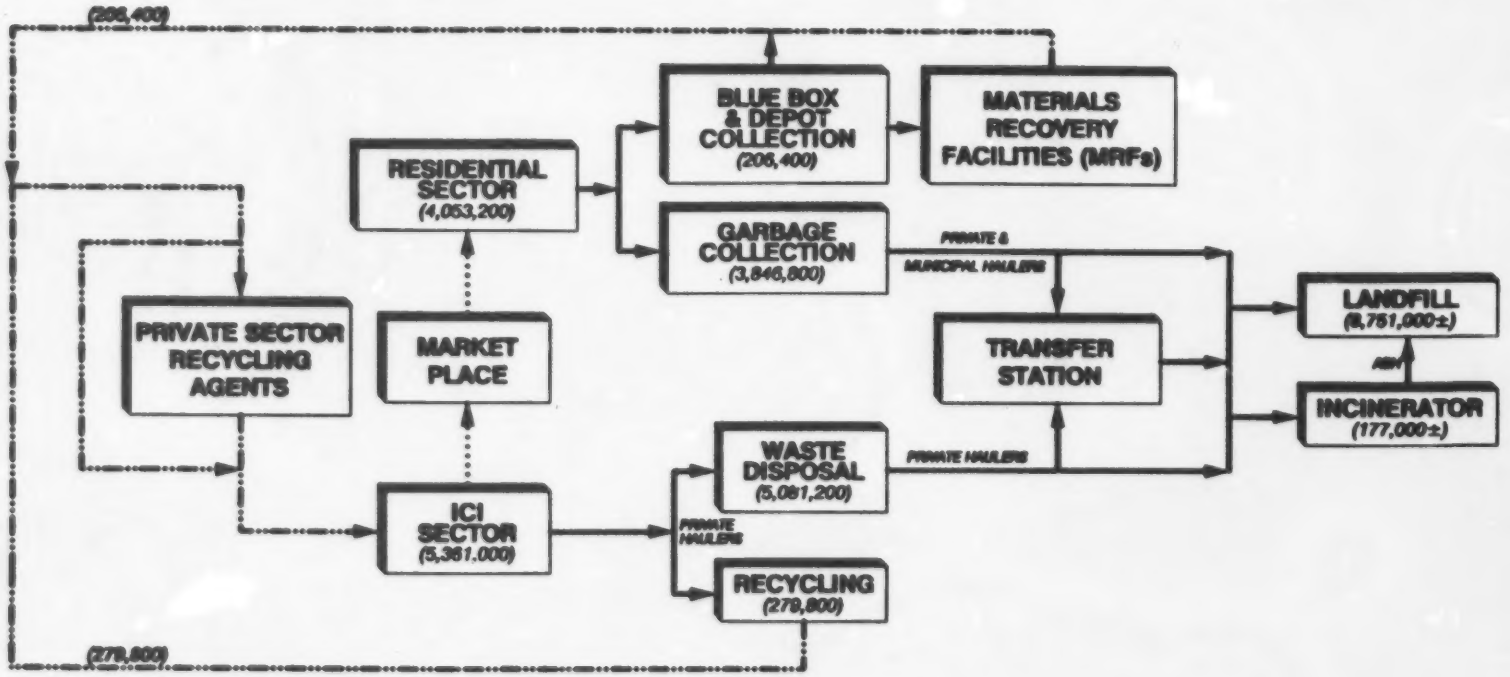



**Figure 4.1**
**ONTARIO'S WASTE MANAGEMENT SYSTEM AND IDENTIFIED MATERIAL FLOW QUANTITIES, 1989**

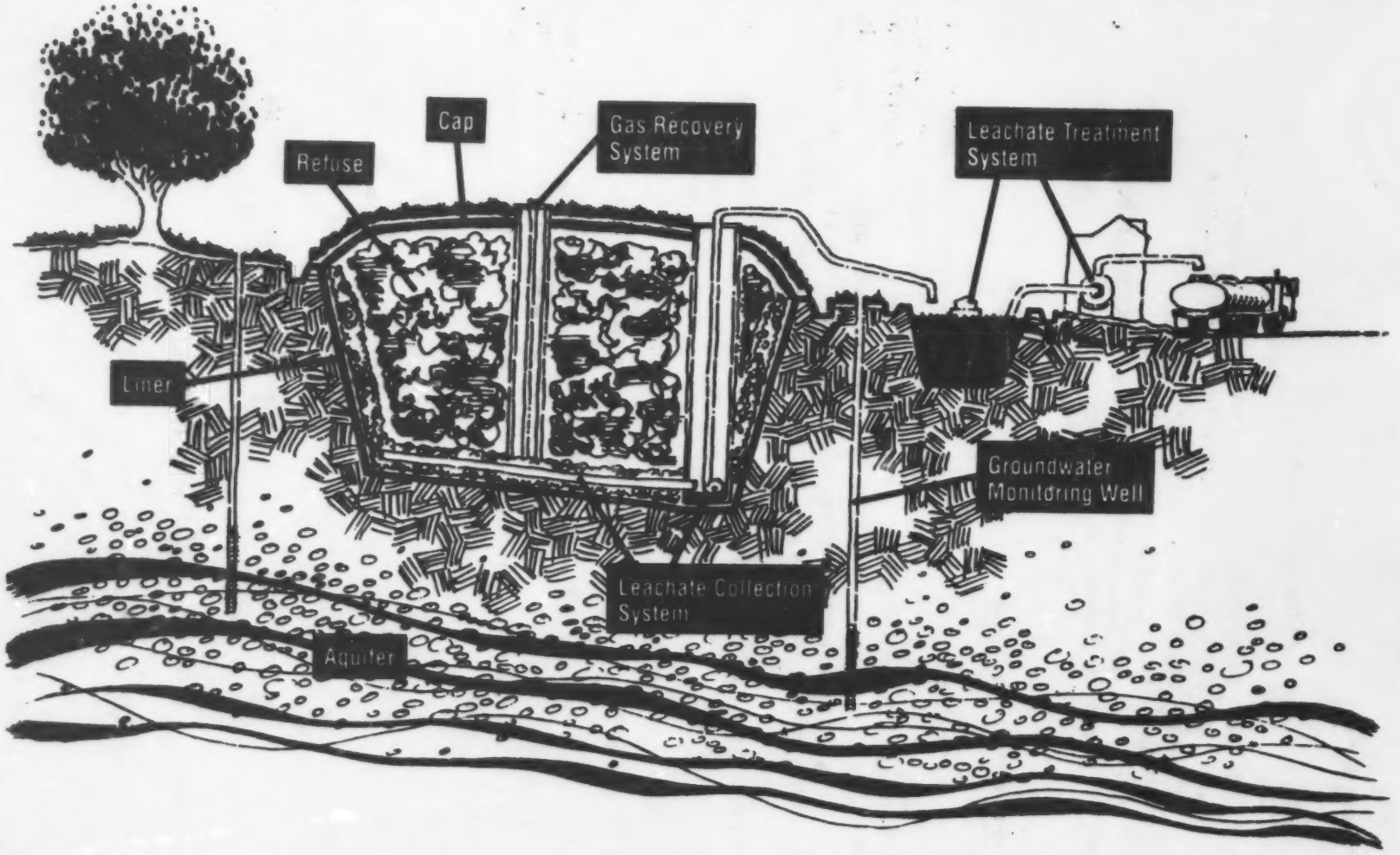



**Figure 4.2**
**MODERN LANDFILL DESIGN**
**Reference: NSWMA, 1990**

## Leachate Management

The main elements of leachate management are:

- Use of low permeability cap to prevent or minimize infiltration.
- Site selection based on high natural attenuation of native soils.
- Placement of a clay or synthetic liner.
- Leachate collection, removal and treatment.
- Adequate surface drainage and flooding properties at the site.
- Prohibition on disposing liquid wastes.

## Refuse Generated Gas Management

As solid waste decomposes, gases, consisting largely of carbon dioxide and methane, are generated. Control of this gas is necessary to eliminate odours and prevent off-site migration of methane in the soil. Piping is placed alternately with layers of solid waste to vent the gases and prevent the buildup of differential gas pressures in the system. In some cases, gas removal is enhanced using a pumping system and, in the case of larger sites, recovery of methane as a heating or combustion fuel may be feasible.

For landfills where the above system was not incorporated into the initial design, a top down retroactive gas vent installation can be considered.

## Nuisance Management

Proper compaction of waste using heavy equipment such as compactors and dozers and use of cover material on a daily basis will reduce nuisance aspects such as dust, litter and pests. Operating hours agreeable to neighbours and well-planned haul routes will minimize traffic complaints.

## Site Records

Site records should be kept of the following information:

- Source quantity and type of waste received from each incoming vehicle, as well as identification and time of arrival of each vehicle.
- Each vehicle rejected and/or waste loads removed.
- Daily tally of tonnage or waste received.

- Quantities of clean fill imported.
- Ultimate use made of imported fill.
- Data accumulated from the site monitoring programs.

Landfill development should be documented annually and contour mapping produced. Inspection records should be kept on the installation of all site works, and on any remedial work carried out. Notes should be kept on construction problems and on complaints from area residents including the responses given.

## Monitoring Strategy

Monitoring will ensure continued satisfactory performance of the landfill. This should include aspects such as:

- Protection of the integrity of the containment system.
- Maintenance of the gas control system.
- Maintenance of the leachate collection, removal and treatment system.
- Groundwater monitoring at near-site wells.

## Closure and Post-Closure Care

A protective cover or cap is necessary to ensure that liquid infiltration to the site is minimized over the long term. This cover should be of low permeability and be vegetated. Such a system could consist of a native soil cover, a high permeability drainage layer to intercept infiltration through the cover and a low permeability cap, placed directly over the waste, constructed of native clays, synthetic membranes or a soil/bentonite mixture.

Finally, the potential for long-term, unacceptable environmental impacts has led to increasingly stringent conditions of approval being imposed on new landfill sites. Financial commitments are required to ensure the continuation of leachate and gas monitoring beyond site closure until such time as it is shown to be unnecessary. Therefore, provisions for long-term contaminant control, with suitable contingency measures, must be included in financial planning for land disposal sites. Long-term funding requirements could include environmental impairment insurance, small claims funding and funds to adequately maintain the closed site. Also, it should be borne in mind that whether privately or municipally owned, the major site users (e.g. municipalities served) may still be responsible for future works required at the site.

### 4.2.2 Physical Dimensions

As discussed in Chapter 2, the primary source of information on landfills was the Site Summary Reports (SSR) provided through the Waste Management Branch. These provided the following information:

- Location
- Certificate of Approval holder
- Operator
- Municipalities served
- Tonnages of domestic, commercial and non-hazardous industrial wastes received.
- Start-up date for landfill
- Remaining life of the site

The latter information was based on the date of the SSR for each site. These dates ranged from 1983 to 1988 and so the remaining life figures do not provide a consistent basis for estimating the closure date of the landfill.

Information from WMMPs was used to update the SSR data where it was possible to confirm a match of records on a specific landfill. In general, little new information was gleaned from this exercise, with the exception of tonnage data.

These two sources of information contained no information on landfills in northern Ontario. Well over half of the landfills in Ontario are located in the Northwestern and Northeastern Regions. The MOE Approvals Branch provided a listing of major landfills in the Northeastern Region and the Northwestern Regional MOE office supplied information for its area. For the Northwestern Region, landfills serving more than 1,000 people were identified, while in the Northeastern Region, landfills serving more than 1,500 people were listed. In total, this amounted to fewer than 100 landfills. Unfortunately only location information was available on these landfills.

The mail-out survey conducted by VHB and MacLaren as part of a concurrent study received responses from more than 200 landfills in Ontario. The database file on landfills was updated to include data from the VHB/MacLaren survey on:

- remaining life
- capital and operating costs
- full- and part-time employment
- 1989 tipping fee

The data on remaining life obtained from the VHB/MacLaren survey is considered more accurate than that from the SSRs.

The preceding exercise compiled the most comprehensive record of landfills possible for this study. However, it is important to recognize the limitations of the information gathered. Many medium and small landfills have no facilities to weigh incoming waste and therefore tonnages may be estimates only, or missing entirely in many cases. All of the SSR and VHB/MacLaren survey information is based on self-report, resulting in little quality control on the data. Nonetheless, this is believed to be the most up-to-date and comprehensive information available.

Inventory figures from the Waste Management Branch indicate that approximately 630 (45%) of Ontario's landfill sites serve communities with populations less than 1,500; these communities constitute approximately 10% of Ontario's total population. Another 350 (25%) of Ontario's landfills are operated by the Ministry of Natural Resources. These landfills are operated to serve provincial parks and other recreational facilities on crown land, areas of seasonal residences (i.e. cottages) and other MNR activities such as clearing associated with reforestation. The main focus of this study has been on the remaining 30% (roughly 420) of the landfill sites serving populations greater than 1,500. The database created as part of this study includes information on the MNR sites.

## Landfill Closure Trends

Since the publication of "Blueprint for Waste Management in Ontario" by the MOE in 1983, increasing attention has been paid to waste management issues. One of the most important of these is the ongoing closure of landfills as capacities are reached, while approvals for new landfills have ground to a virtual halt due to public concerns over environmental acceptability.

As an example of the critical nature of this issue, approximately 18% of Ontario's annual landfill capacity will be lost in 1991, with the closure of two of the province's three largest landfills. Together, Britannia (750,000 tonnes/year), Brock West (964,000 tonnes/year) and Keele Valley (2,250,000 tonnes/year), all located in the Greater Metro Toronto area, accept approximately 42% of the total provincial annual waste generation. Two of these landfills, Britannia Road in Mississauga, and Brock West in Pickering, are projected to close at the end of 1991. Britannia Road may remain open longer if the existing site is filled beyond originally approved final contours. This issue is under consideration at this time and a final decision has not been reached. If both landfills close as projected, an estimated 18% of the Provinces landfill capacity will be lost. The Keele Valley site is projected to close in 1993-1994, eliminating a further 24% of the Provinces landfill capacity.

The Site Summary Reports provide estimates of landfill life expectancy in years. This information was entered into the study database directly. Information received from the MOE indicates that these data were calculated based on the year of the Site Summary update. Using this information, the number of landfills expected to reach their

approved capacities at various times was calculated. Since the Site Summary Reports were updated between 1983 and 1988, it has not been possible to verify whether closures anticipated for the period 1983 to 1990 occurred. Although considered of limited value, the results of this exercise are discussed below and are presented in more detail in Section 4.2.5.

Out of 665 landfill records obtained for this study approximately 34% (224) have no data regarding the remaining life expectancy of the landfill. Of the 499 records that have this information, 158 (32%) indicate a remaining landfill life of seven years of less. Because the base year of the data was generally 1983, the SSR suggests that these 158 landfills can be assumed to have reached their approved capacity by 1990. The SSR data further suggest that an additional 95 (19%) landfills will reach capacity in the 1991-1993 period. An additional 145 (29%) will attain full capacity between 1994 and 2003 with only 101 (20%) extending beyond 2004.

Eighty-one of the landfills expected to reach their approved capacity by 1990 receive less than 5,000 tonnes of wastes per year. Only 6% of the landfills expected to reach capacity by 1990 received wastes in excess of 50,000 tonnes annually. For landfills expected to attain full capacity in the 1991-1993 period, 84% receive wastes at rates less than 5,000 tonnes per year. However, two of the three largest landfills in Ontario are also expected to reach capacity during this period.

Landfills expected to reach capacity in the period between 1983 to 1990 are distributed fairly evenly across the province with one to five landfill closures per county. Based on the available information, a large proportion of the landfills expected to reach capacity are located in Peterborough County, Simcoe County, Haliburton County and Niagara Region. Landfills expected to reach capacity during the 1991-1993 period are also evenly distributed among the counties. During the period from 1994-2003 there will be one to five landfills reaching approved capacity for each county with the exception of Renfrew, Bruce, Frontenac, Huron, and Peterborough Counties, where more than five closures are expected.

The above data need to be verified by an update of all SSR's, preferably carried out in the same base year. The focus on waste management has changed dramatically since some of the SSR work was initially carried out. It is likely that more comprehensive data would be available on projected closure dates etc. if all SSR's were updated in 1991. Landfill closures are discussed further in Section 4.2.4. Future Trends.

### 4.2.3 Economic Dimensions

#### Landfill Tipping Fees

Tipping fee information was obtained from Waste Management Master Plan data as well as the mail survey conducted by VHB/MacLaren, as part of a concurrent study.

Responses were received for 205 landfills, 56 large landfills receiving more than 5,000 tonnes of waste per year and 149 small landfills receiving less than 5,000 tonnes of waste per year. In addition, some tipping fees were obtained from WMMPs.

Tipping fees at small landfill sites, (less than 5,000 tonnes of waste per year), vary from zero to fees based on vehicle size. Only 37 (25%) of the small landfill respondents indicated that they had a tipping fee. Only 12 (8%) indicated that a specific portion of the waste management costs were accounted for by the tipping fee. Most of the smaller landfills do not have weigh scales and, therefore, cannot charge a fee based on tonnage. Generally, the revenues earned from tipping fees are used to pay the salaries of the employees who control access to the site.

Of the 56 large landfill (greater than 5,000 tonnes of waste per year) survey respondents, 13 (23.2%) indicated that they had no tipping fees. Seventeen (30.4%) landfills charge tipping fees based on vehicle size and/or type of waste material (e.g. charge per tire). Four of the landfills surveyed charged more than $90 per tonne at the time of the survey (summer 1990) including Brock West, Keele Valley and Britannia. Three landfills charged between $70 and $90 per tonne, eight between $30 to $70 and five less than $30. Seven respondents did not provide information on tipping fees. Only 19 (38%) of the respondents indicated that a specific part of their waste management costs are accounted for in the tipping fee. The preceeding discussion pertains to 1990 tipping fees, while 1989 tipping fees appear in the landfill database.

There are a variety of ways to charge a tipping fee on a vehicle entry basis. The simplest method is to charge a per vehicle rate for each entry into the landfill. The rates can be based on vehicle type or weight capacity. Vehicle type categories can range from personal use cars, cars with trailers, commercial truck (1/4-1 ton), cube vans and platform bodies, lugger containers and rolloffs to compactors, refuse trucks and semi-trailers. Often a higher tipping fee (in some cases twice as high) is charged to non-residents of the area served by the landfill. Table 4.1 summarizes reported vehicle based tipping fees from 1987 to 1990.

Table 4.2 lists available information on tonnage based tipping fees since 1984 for a number of municipalities. Information on selected municipalities appears in graphical form in Figure 4.3. It is important to note the dramatic rise in tipping fees, especially since 1987 and in larger centres. It is interesting that in smaller centres such as Lindsay there has been some resistance to raising tipping fees. Fears that illegal dumping may result may soon be offset if other municipalities begin to take advantage of lower tipping fees. For example, the costs to haul waste to Lindsay from Peterborough may justify taking advantage of the difference in tipping fees noted in Figure 4.3.

It is also noteworthy that tipping fees in the Greater Toronto Area have increased to $150/tonne in 1991.

## Table 4.1
## SUMMARY OF AVAILABLE DATA ON VEHICLE BASED TIPPING FEES IN ONTARIO (1987-1989)

| Site Location | 1987 | 1988 | 1989 | 1990 |
|---|---|---|---|---|
| Cobourg | | $0-20/VEH. | $3-45/VEH. | 5.75/C.Y. |
| Hanover/Walkerton | $1-10/VEH. RES<br>$2-14/VEH. NRES | | | |
| Brockville | | $0-64/VEH. RES<br>$5-128/VEH. NRES | $0-130/VEH. CRES<br>$10-260/VEH. CNRES | $0-130/VEH. CRES<br>$45-345/VEH COMM |
| Thurlow Twp | | | $10-125/VEH. NC<br>$75-125/VEH. C | $10-125/VEH. NC<br>$75-125/VEH. C |
| Listowel | 0 | 0 | 0 | 0 |
| Mosa | 0 | 0 | 0 | $25/TRAILER<br>SHINGLES ONLY |
| Kincardine | 0 | 0 | 0 | 0 |
| Baxter | 0 | 0 | 0 | 0 |
| Foothill | 0 | 0 | 0 | 0 |
| Fort Erie | 0 | 0 | 0 | 0 |
| Niagara on the Lake | $0-125/VEH. | $0-125/VEH. | $2-160/VEH. | $2-216/VEH. |
| West Garafraxa | 0 | 0 | 0 | 0 |
| Keswick | 0 | 0 | 0 | $10-100/VEH. |
| Morrisburg | 0 | 0 | 0 | 0 |
| Wasaga Beach | 0 | 0 | 0 | 0 |
| Niagara Falls | 0 | 0 | 0 | 0 |
| Ameliasburgh | 0<br>0 | 0<br>0 | 0<br>0 | $5 PER 1/2 TON TRUCK<br>$100/ SINGLE AXEL |
| Welland | 0 | 0 | 0 | 0 |
| Tillsonburg | 0 | 0 | 0 | 0 |
| St Catharines | 0 | 0 | 0 | 0 |
| King Twp | 0 | 0 | 0 | 0 |
| Mitchell | 0 | 0 | 0 | $5-10/VEH |
| Durham | 0<br>0 | 0<br>0 | 0<br>0 | $6-80/VEH. R<br>$8-100/VEH. NR |
| South Hampton | 0 | 0 | 0 | $2-70/VEH. |
| Wingham | 0 | 0 | 0 | 0 |
| Pembroke | 0 | 0 | 0 | 0 |
| Chesley | $25/LOAD/ENTRY<br>ON UNOPENED DAYS | $25/LOAD/ENTRY<br>ON UNOPENED DAYS | $25/LOAD/ENTRY<br>ON UNOPENED DAYS | $25/LOAD/ENTRY<br>ON UNOPENED DAYS |
| Renfrew | $1.50-18/VEH. | $1.50-18/VEH. | $1.50-18/VEH. | $1.50-18/VEH. |
| Moore Twp | $0-3/C.Y. R<br>$3-5/C.Y. NR | $0-3/C.Y. R<br>$3-5/C.Y. NR | $5-8/C.Y. R<br>$7-12/C.Y. NR | $8/C.Y. R<br>$16/C.Y. NR |
| Hastings | 0 | 0 | 0 | $10-150/VEH. |
| Almonte | $2-100/VEH. | $2-100/VEH. | $2-100/VEH. | $2-150/VEH. |
| Puslinch | $14/TONNE COMM. | $14/TONNE COMM. | $30/TONNE COMM. | $76/TONNE |

Source: Data obtained from landfill survey completed by VHB Research & Consulting, Inc.

## Table 4.2
## SUMMARY OF DATA ON TONNAGE BASED LANDFILL FEES IN ONTARIO 1984–1990

| Location | Reported tipping Fee $/tonne | | | | |
|---|---|---|---|---|---|
| | 1984 | 1987 | 1988 | 1989 | 1990 |
| Barrie | | | 12.50 | 28.30 | 85.00v |
| Belleville/Napanee | | | 34 | | |
| Brantford | | | 10 | 13 | |
| Collingwood | | | | 15 | 50 |
| Durham | | | 50 | 83.34 | |
| Essex-Windsor | 14 | | 23.90 | 32.50* | |
| Goefield | | 20-27+v | | | |
| Grimsby | | 32 | 50 | 58v | 85v |
| Guelph | 0 | 14.6<br>43+v | 28 | 33<br>48+v | 38<br>76+v |
| Haldimand-Norfolk | | | | 25.00+<br>0n | |
| Halton Region | 18 | 36.15 | 53.50 | 83.50 | 115 |
| Hamilton-Wentworth | 20 | 27 | 28.60 | 80 | 110 |
| Hastings | | | 17 | 37.50 | |
| Huntsville | | 0v | | 27.50v | 55v |
| Kitchener/Waterloo | 7.95 | 17.05 | 30.80 | 4.75b<br>2.25c | |
| Lindsay | | 6-7v | | 12-13 | 20v |
| London | | 13.50 | 15.40 | | 35 |
| Mississauga (Brittania) | | 49.50+v | | 70-90+v | 90-95+v |
| Newcastle | | 20 | 60 | 95 | 115-130 |
| Niagara Waste Systems | | | 26 | | |
| North Simcoe | | | | 112<br>35 | |
| Occidental (New York) | | 8.65 | | | |
| Orillia | | | | 36.50 | |
| Oro | | 0v | | 0v | 25v |
| Ottawa | | | 27.50 | 35<br>33 | |
| Paris | 0 | 0 | 0 | 25 | |
| Peel Region | 13.50 | 34.50 | 49.50 | 70 | 90 |
| Peterborough | 0 | 0 | 0 | 50 | 75 |
| Pickering (Brock West) | | 18.07+v | | 83.33+v | 97.50+v |
| Port Elgin | | | | 0 | |
| Red Lake area | | | | 0 | |
| South Gray | | | | 7+<br>83.34 | |
| South Simcoe | | | 50 | 83.34 | |
| Steetly Industries Ltd. | | 20 | 28 | 48 | |

## Table 4.2
## SUMMARY OF DATA ON TONNAGE BASED LANDFILL FEES IN ONTARIO 1984–1990

| Location | Reported tipping Fee $/tonne | | | | |
|---|---|---|---|---|---|
| | 1984 | 1987 | 1988 | 1989 | 1990 |
| Stratford | | 0 | 0 | 0 | 10 |
| Sudbury Region | | | 0 | 0 | |
| Thunder Bay | 3 | 7 | | 8 | |
| Timmins | | | 0 | | |
| Metro Toronto | 15.50 | 18.07 | 50 | 83.34 | 98 |
| (at transfer stations) | | | | 100 | 15 |
| Vaughan (Keele Valley) | | 18.07+v | | 83.33+v | 97.50+v |
| Average Tipping Fee | 13.28 | 20.80 | 33.93 | 49.40 | 76.61 |
| Percentage Increase | | 56.6% | 63.1% | 45.6% | 55.1% |

Legend:

* -under review  a -at all others  c -per cubic year - loose

\+ -at one facilty  b -per cubic yard - packed  v -from VHB survey

Sources:

- Association of Municipal Recycling Co-ordinators (AMRC) files
- MacLarens in-house files
- VHB/MacLaren Survey (1990) where noted

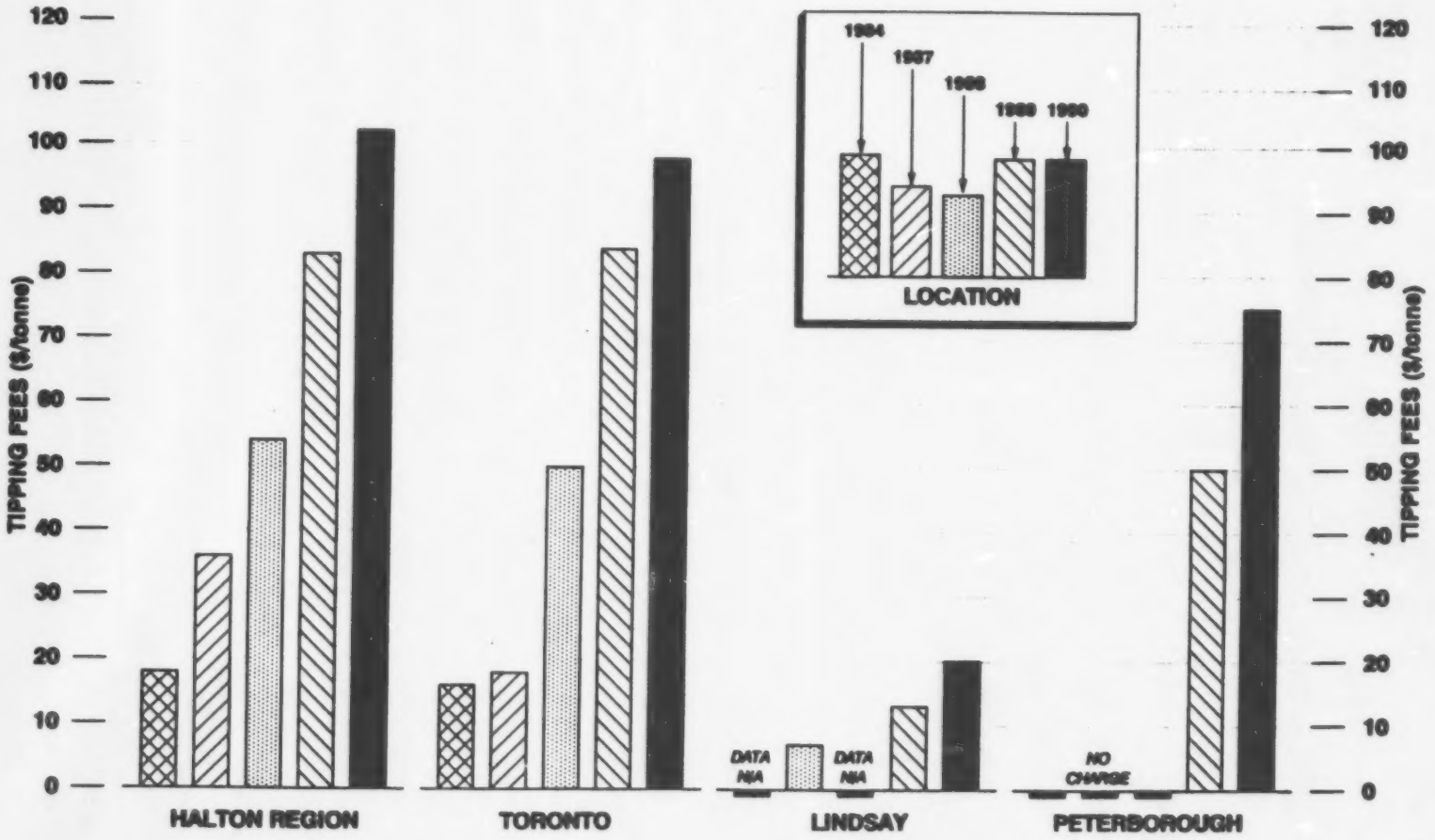



**Figure 4.3**
**HISTORY OF LANDFILL TIPPING FEES**
**FOR SELECTED MUNICIPALITIES**

**Landfill Employment**

Survey information on employment was only available for the large landfills. Forty-one (41) landfills responded indicating a total employment of 260 full time and 115 part time employees. Seventy six percent (76%) of the responding landfills employ five or less full time employees. Ninety-three (93) of the responding landfills employee five or less part time employees. Britannia, Brock West and Keele Valley collectively employ 60% and 26% of the reported full- and part-time employees respectively.

Table 4.3 and Figure 4.4 were developed from the data available and provide an overall picture of landfill staffing requirements as a function of the annual tonnage of waste received at a landfill.

**Landfill Operating and Capital Costs**

Capital and operating costs for landfilling can vary widely depending on a number of factors. Well-designed landfills address the question of leachate management by considering native soil types and treatment alternatives. Other factors which may contribute to variable landfill costs include average haulage distance, provision of closure and post-closure care funds and extent of programs to reduce impacts to neighbouring land uses. The latter may include use of cover material, litter fences and pest control (i.e. control of rats and gulls).

Other factors contributing to landfill costs include:

- Size of landfill
- Staff salary
- Equipment and maintenance (e.g. graders, compactors, dozers, scrapers, etc.)
- Engineering and approvals

Traditionally, municipalities have not maintained comprehensive records of costs associated with the operation of their landfills. Table 4.4 has been developed from MacLaren in-house files to show the range in costs for landfills of differing size and location. These costs should be considered generic, but representative of the types of landfills most commonly found in Ontario.

### 4.2.4 Future Trends

Landfilling is the most extensively used method of waste management in Ontario. Despite recent recycling efforts which, in 1989, diverted 206,400 tonnes of the waste produced by the residential sector in Ontario and an estimated 279,800 tonnes of waste produced by the ICI sector, up to 9,000,000 million tonnes of residential and commercial/industrial wastes were landfilled.

Table 4.3
COMPARISON OF LANDFILL UTILIZATION AND EMPLOYMENT FOR SELECTED LANDFILLS IN ONTARIO

| Site Location | Waste Received Tonnes/Year | Employees | |
|---|---|---|---|
| | | Full Time | Part Time |
| Georgina Twp | 12,200 | 2 | 0 |
| King City | 7,000 | 1 | 2 |
| Huntsville | 8,000 | 2 | 0 |
| Georgian Bay | 2,300 | 1 | 1 |
| Barrie | 43,360 | 4 | 2 |
| Oro Twp | 2,800 | 1 | 1 |
| Cramabe | 2,300 | 2 | 0 |
| Haldimand | 23,844 | 3 | 0 |
| Percy | 1,800 | 0 | 1 |
| Ops | 11,700 | 2 | 1 |
| Albemarle Twp | 1,300 | 0 | 0 |
| Brant Twp | 8,000 | 2 | 2 |
| Saugeen Twp | 2,400 | 0 | 1 |
| Alice&Fraser Twp | 28,080 | 2 | 3 |
| Leeds&Lansdowne Twp | 32,294 | 1 | 0 |
| North Colchester | 26,400 | 2 | 1 |
| Maidstone | 220,400 | 9 | 3 |
| Tillsonburg | 8,030 | 5 | 0 |
| Listowel | 3,700 | 0 | 1 |
| Mitchell | 2,000 | 1 | 0 |
| Mississauga | 748,338 | 30 | 1 |
| Brock | 964,004 | 45 | 10 |
| Moore | 12,000 | 0 | 2 |
| Ottawa | n.a. | 12 | 3 |
| Guelph | 6,657 | 0 | 3 |
| Paris | 9,844 | 4 | 0 |
| Brantford | 115,226 | 0 | 0 |

Source: VHB/MacLaren Survey Results (1990).

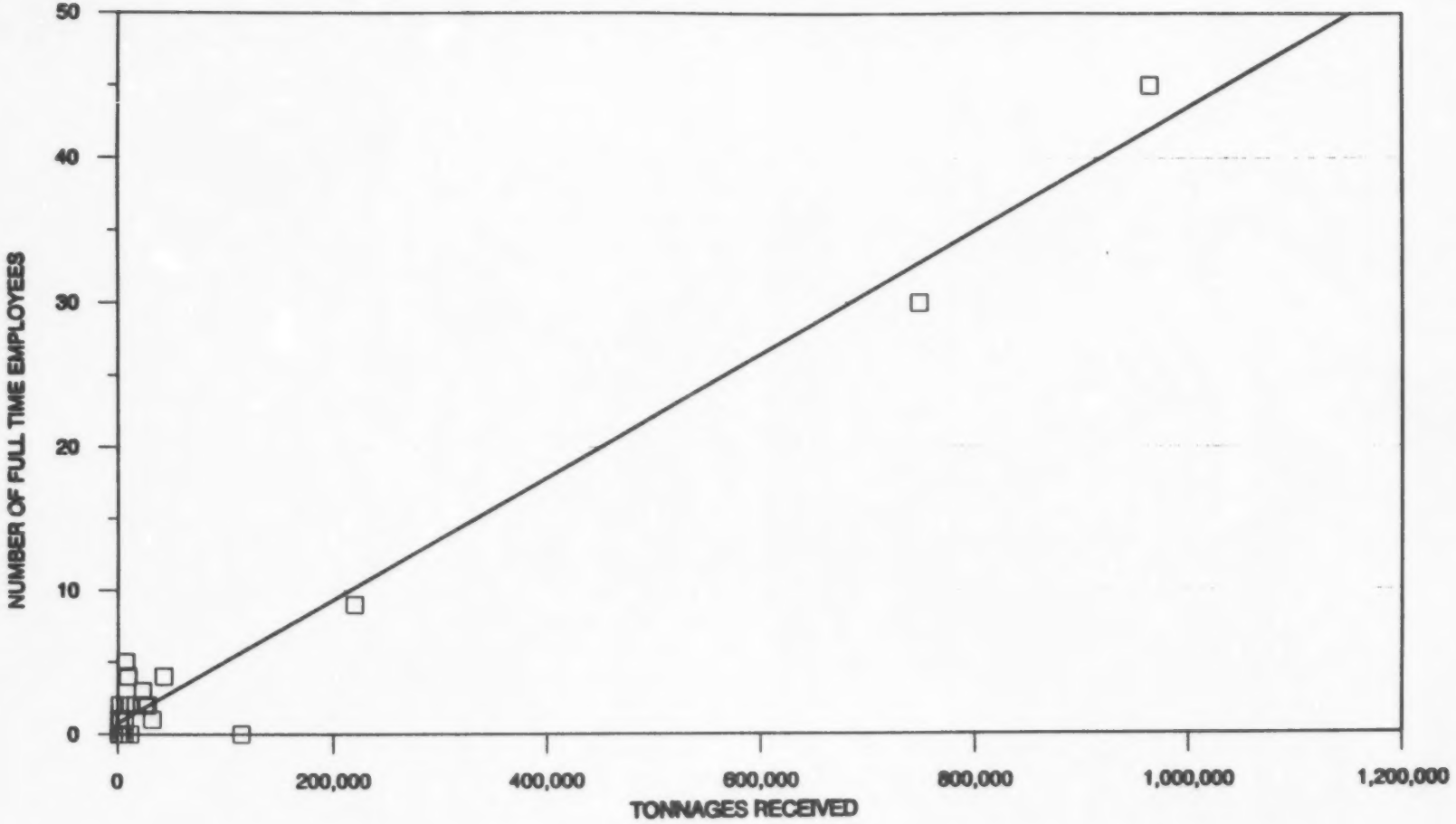



**Figure 4.4**

**COMPARISON OF TONNAGES RECEIVED AND FULL TIME EMPLOYMENT AT SELECTED LANDFILLS**

## Table 4.4
## GENERIC COST OF LANDFILLING ACTIVITIES FOR THREE SCENARIOS IN ONTARIO

| Landfill Characteristics | Scenario 1 | Scenario 2 | Scenario 3 |
|---|---|---|---|
| Total Capacity (T) | 100,000 | 2,000,000 | 20,000,000 |
| Avg. Haul Distance (KM) | 30 | 20 | 20 |
| Soils | Clay | Glacial Till | Glacial Till |
| Leachate Management | Natural Attenuation | Treat & Pump To Sewer | Treat & Pump To Sewer |
| **Costs** | **Scenario 1** | **Scenario 2** | **Scenario 3** |
| Engineering/Approvals | $911,405 | $1,443,514 | $2,193,122 |
| Compensation | $311,405 | $543,514 | $1,193,122 |
| Construction | $790,950 | $4,146,094 | $24,262,799 |
| Operating Costs | $247,524 | $2,417,762 | $17,119,344 |
| Equipment Replacement | $441,088 | $1,114,000 | $1,114,000 |
| Leachate Treatment | | | |
| - Capital Costs | $229,088 | $2,221,906 | $10,146,607 |
| - Operating Costs | $3,000 | $167,148 | $708,523 |
| Total Site Closure | $19,460 | $259,324 | $2,709,692 |
| Annual Post Closure Care | $29,631 | $230,841 | $1,211,234 |
| Required Closure Fund | $1,084,908 | $10,448,146 | $61,823,712 |

Source: MacLaren in-house files.

Landfills in Ontario are closing at a steady rate as summarized in Table 4.5 and discussed Section 4.2.2. By 1994, 50% of the landfills that were operating in 1983 will have reached their approved capacity. This trend affects smaller landfills disproportionately; approximately 82% of the landfills expected to reach capacity by 1991 to 1993 accept less than 5,000 tonnes of wastes a year. This trend will also affect large landfills (greater than 50,000 tonnes) namely Brock West, Britannia and Keele Valley, all of which will be closed by 1994.

To date, new approved landfill capacity has lagged behind landfills reaching capacity. However, Waste Management Master Plans are being undertaken in 34 areas covering 75% of the province's population. It is not clear though, whether new capacity will be approved in many areas of the province before existing approved capacity is exhausted.

**Table 4.5**
**REPORTED DATES WHEN ONTARIO LANDFILLS ARE EXPECTED TO REACH APPROVED CAPACITY**

| | Size (Tonnes of Waste Accepted Annually) | | | | |
|---|---|---|---|---|---|
| | Less than 5,000 | 5,000 to 10,000 | 10,000 to 50,000 | 50,000 to 100,000 | Greater than 100,000 |
| End of 1990 | 128 | 10 | 11 | 1 | 8 |
| 1991 to 1993 | 80 | 5 | 8 | 1 | 1 |
| 1994 to 2003 | 124 | 5 | 12 | 2 | 2 |
| 2004 and beyond | 85 | 9 | 4 | 2 | 1 |

Source: MOE Landfill Site Summary Reports

There has also been a trend toward larger regional landfills, and away from local community landfills. This is generally done to gain greater control over the management of the landfill and for greater cost effectiveness. Finding a host community for the landfill, however, is becoming increasingly difficult, because although the public has become more informed about waste management issues, and the need for new landfills has gained significant attention, opposition to landfills has grown. Typical public concerns include decreased property values, increased traffic and the resulting dust and noise, wind-blown litter, and pests such as gulls and rats.

There is a trend towards more tightly regulated landfills. This follows from an increased awareness and understanding of the potential environmental damage caused

by landfilling activities. As a result, the landfill approval process has also become increasingly stringent. New landfill designs are required to make provisions for leachate control and monitoring, noise, dust and nuisance control.

Landfill tipping fees have increased in the past 2-3 years and continue to climb. Although some communities are raising their landfill tipping fees to account for specific parts of their waste management costs and possible to encourage diversion from landfill, many are raising their fees to discourage other communities or regions from using their landfills. Smaller communities are reluctant to raise their landfill tipping fees for fear that illegal dumping will occur as a result.

## 4.3 INCINERATORS

### 4.3.1 General Description

The objective of incineration is to reduce the volume of the wastes for disposal through controlled combustion. Volume reductions of 80-90% are possible for the combustible portion of the wastes using incineration. This method of waste treatment is costly and, consequently, is often coupled with energy recovery to make the process more economically feasible. In this case, it is referred to as Energy From Waste, or EFW.

Three types of wastes are produced by the incineration process; fly ash, bottom ash and waste gases. Bottom ash is the solid residue remaining following combustion; this ash can be disposed of in a sanitary landfill. Fly ash is the solid residue removed from the combustion gas stream; the status of fly ash is currently under review by the MOE and consequently fly ash must be disposed of at a secure landfill. Figure 4.5 presents a simple schematic of the incineration process.

### 4.3.2 Physical Dimensions

Currently there are three incinerators in Ontario that accept solid non-hazardous waste. Two of these (3M and Victoria Hospital) are located in London, the third (Solid Waste Reduction Unit or SWARU) is located in Hamilton. A new facility is under construction in Brampton with an anticipated 1992 start-up date. All three existing facilities recover energy from the incineration process. All three existing facilities dispose of their fly ash waste at Laidlaw's secure landfill located in Sarnia. Bottom ash is landfilled locally. All three use fabric filters (i.e. baghouses) to remove dust from waste gases. In addition, 3M and Victoria Hospital operate dry scrubbers to remove unwanted gases, while SWARU uses lime injection (Kiser, 1990). A summary of the physical dimensions of these facilities appears in Table 4.6.

The history of the Commissioners Street Incinerator is also of interest to this study since it operated until August 1, 1988. It's capacity was 900 tonnes per day and it operated 24 hours a day, seven days a week. It accepted domestic and commercial waste

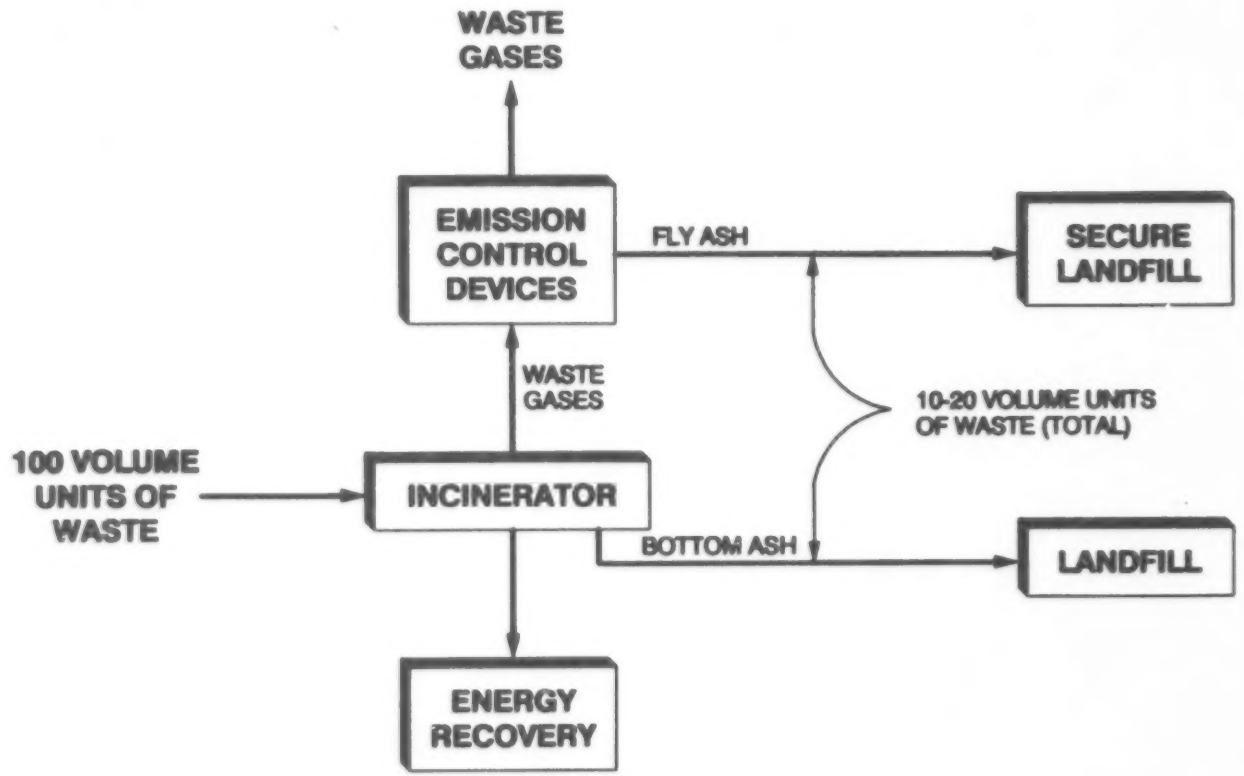



**Figure 4.5**

**INCINERATION SCHEMATIC**

**Table 4.6**
**SUMMARY OF PHYSICAL DIMENSIONS OF SOLID WASTE INCINERATION IN ONTARIO**

| Incinerator | Waste Source | Tonnage (tonnes/ year) | Employ- ment (full-time) | Use of Energy Recovered | Start-up Year & Comments on Operation* | Design Capacity* (tonnes/day) |
|---|---|---|---|---|---|---|
| SWARU, Hamilton | Approx. 80% of Hamilton and Stoney Creek residential waste. Municipal haulers only. | 92,000 | 40 | Electricity sold through Ontario Hydro (4 MW); also steam gener- ation | 1972/refitted in 1986 | 545 |
| 3M, London | ICI - commercial waste haulers only. | 3,000 | 5 | Heat on-site facilities | 1987; shutdowns fre- quent, operate approx. 50 days/yr. | 57 |
| Victoria Hospital, London | Approx. 60% of City of London residential waste. | 82,000 | 28 | Steam and hydro generation for University of Western Ontario campus | Operating at about 300 t/ day or 75% capacity. Approvals process began in 1983. | 272 |

Sources: *Waste Age*, 1990*
Personal Communication with operator.

that amounted to about 4% of the solid waste disposed by Metro Toronto, along with solid waste from Pearson International Airport. Ash from the facility (43,453 tonnes in 1986) was hauled to the Brock West Landfill, rather than to a secure facility, as is required for present-day facilities. Full-time staff numbered 65, including supervisory and maintenance staff. Incineration provided for steam generation. The incinerator was closed due to mounting opposition from public interest groups such as Pollution Probe and Citizens For A Safe Environment. They successfully argued that 3R's strategies should be placed ahead of incineration in solid waste management priorities and that more emphasis should be placed on energy conservation rather than on increasing energy supply through refuse incineration.

It should be noted that Ford in Oakville, GM in Oshawa and St. Lawrence Cement all operate their own incineration facilities but do not accept waste from other sources (Waste Age, 1990).

## 4.3.3 Economic Dimensions

### Incinerator Tipping Fees

The tipping fee at the Victoria Hospital Incinerator is $5.68/tonne. The 3M Canada incinerator tipping fee is comparable to the local landfilling tipping fee of $35/tonne. SWARU charges a tipping fee of $55 per tonne for municipal wastes.

### Incinerator Capital and Operating Costs

Over the past several years, incineration technology has changed and become more complex in response to increasingly stringent air emissions regulations. Incinerators such as SWARU have undergone substantial retrofitting since first being installed, making it difficult to assess complete capital and operating costs. The approach used here is to develop costs based on anticipated technological and environmental requirements for an incinerator built now. Generic capital and operating costs have been developed for EFW plants (see Table 4.7), based on MacLaren in-house files.

**Table 4.7**
**ENERGY FROM WASTE FACILITY GENERIC COSTS**

| Capacity | | | |
|---|---|---|---|
| TPY (tonnes/year) | TPD (tonnes/year) | 1990 Capital Cost (x 1,000) | 1990 $/Tonne Operating Cost |
| 113,000 | 364 | 53,206 | 67.50 |
| 205,000 | 660 | 93,190 | 63.50 |
| 931,000 | 3000 | 299,250 | 43.50 |

The following factors contribute to capital and operating costs of EFW facilities:

- Number and size of incinerators, boilers and flue gas cleaning devices.
- Trucking of solid waste and ash.
- Staff requirements.
- Plant availability.

### 4.3.4 Future Trends

Extensive research has been undertaken over the past several years into the environmental impact of incinerator emissions. This research has demonstrated that well operated, state of the art incineration facilities will meet Ontario's air emission regulations. Public uncertainty on this issue remains, however, especially with regard to the formation of toxic compounds such as dioxins which result from the incomplete combustion of plastics.

Incineration remains a relatively costly option for waste disposal in many situations, as indicated by the capital and operating cost estimates presented above. Consequently, landfilling is often more economically attractive as a waste disposal technology.

Provincial policy in Ontario over the last several years has defined a hierarchy of waste management approaches which identifies the 3Rs as environmentally preferable to incineration with or without energy recovery. Since incineration and recycling may compete for the same materials in the waste stream, policies that prefer recycling have tended not to encourage incineration. For example, recycling of the majority of organically-based wastes such as paper and wood may mean that the remaining waste stream has insufficient heating value to support incineration.

In spite of these factors, incineration offers a method of waste disposal that minimizes the land required for landfilling and provides the potential for reliable waste disposal with some level of revenue generation and energy recovery. With rising landfill tipping fees, incineration is becoming more cost competitive with landfills as well. However, operational problems require careful control. For example, feedstream control and maintenance downtime have proven difficult in the past. Nonetheless, incineration is being actively considered as a waste management option in waste management policy studies across the province.

## 4.4 TRANSFER STATIONS

### 4.4.1 General Description

Transfer stations are the "middle men" of the waste management system, although they are not included in all waste management systems. Their purpose is to bulk incoming wastes from surrounding areas to reduce costs of hauling the waste to a designated end point, usually a landfill. They have become increasingly important in reducing transportation costs as regional waste management facilities replace local landfills.

Transfer stations range in size and complexity. The simplest transfer station consists of one or more open top steel bins with appropriate access ramps, screening and access control. This type of transfer station is typically located in remote rural locations; in northern Ontario many of these transfer stations fall under the jurisdiction of the Ministry of Natural Resources. Transfer stations located in more urbanized regions of

Ontario can range from a simple concrete dumping platform with a 3-sided windbreak to an enclosed multi-level warehouse facility with a dumping area and sub-floor trailer compactors. The Disco Road transfer station in Etobicoke is an example of this latter type.

### 4.4.2 Physical Dimensions

The Regional offices of the MOE were contacted as part of the present study to obtain information pertaining to transfer stations within their respective jurisdictions. The Northwest Region office indicated that there are no MOE administered transfer stations located in that region. However there are approximately 28 transfer stations maintained by the Ministry of Natural Resources. No other information was received from MOE Regional offices.

The type of information available from the MOE on transfer stations is limited to Certificate of Approval data, which includes the location of the transfer station. No other information relating to employment, incoming waste or waste sources and destinations is readily available.

Twenty-nine transfer stations were identified in the Waste Management Master Plans. This information was entered into a database file. Table 4.8 provides a summary of the available information on tonnage of waste handled. Unfortunately, no employment data were available from the WMMPs.

More detailed information on Metro's seven transfer stations is provided by a 1986 SWEAP document. Table 4.9 is taken from that report. While it indicates that total employment at all stations (not including Dufferin) was 135 in 1986, recent discussions with Metro Public Works staff indicate that current employment is 212 full-time and 92 part-time (seasonal) staff.

Due to the fact that information on transfer stations is so scant, and wide-ranging, the data cannot be extrapolated to provide general information on the amounts of waste handled or employment at all of Ontario's transfer stations. The information available from the WMMPs has been entered into the database and can be updated as more information becomes available.

### 4.4.3 Economic Dimensions

#### Transfer Stations Tipping Fees

Only three transfer stations listed in the WMMPs reported a tipping fee (Windsor, Wellesley, Wilmot). These are all 1984 values and are out of date.

| Table 4.8<br>SUMMARY OF WMMP DATA ON TRANSFER STATIONS | | |
|---|---|---|
| **County** | **Location or Municipality Name** | **Tonnage (t/yr)** |
| Perth | Mornington | - |
| Essex | Windsor | 84,550 |
| Haldimand-Norfolk | Dunnville | - |
| Haldimand-Norfolk | Haldimand | - |
| Haldimand-Norfolk | Nanticoke | - |
| Haldimand-Norfolk | Norfolk | - |
| Haldimand-Norfolk | Delhi | - |
| Parry Sound | Kearney | - |
| Parry Sound | Healy Lake | - |
| Frontenac | Kingston | - |
| Peterborough | Cavan Township | 1,800 |
| Simcoe | Adjala Township | - |
| Simcoe | Tecumseth Township | - |
| Metro Toronto | Bermondsey (North York) | 205,193 |
| Metro Toronto | Disco (Etobicoke) | 231,646 |
| Metro Toronto | Dufferin (North York) | 124,359 |
| Metro Toronto | Ingram (North York) | 357,396 |
| Metro Toronto | Scarborough (Scarborough) | 173,169 |
| Metro Toronto | Symes (York) | 109,033 |
| Metro Toronto | Victoria Park (North York) | - |
| Durham | Cartwright | - |
| Durham | Oshawa | - |
| Durham | Newcastle | - |
| Waterloo | Wellesley | - |
| Waterloo | Wilmot | - |

Table 4.9
SUMMARY OF INFORMATION ON METROPOLITAN TORONTO TRANSFER STATION NETWORK 1986

| Metro Transfer Station | Total Waste (tonnes) | Total (t/day) | Source | | Major Service Areas | Destination | Total Employ. (b) |
|---|---|---|---|---|---|---|---|
| | | | Municipal | Comm/Ind | | | |
| Bermondsey | 196,450 | 760 | 149,617 | 46,833 | East York<br>Scarborough<br>North York<br>Toronto | Brock West | 38 |
| Disco | 203,370 | 770 | 117,942 | 85,428 | Etobicoke | Keele Valley | 22 |
| Dufferin (a) | 132,594 | 520 | 78,112 | 54,482 | North York | Keele Valley | n.a. |
| Ingram | 320,725 | 1,100 | 224,943 | 95,782 | York<br>North York<br>Toronto | Keele Valley | 16 |
| Scarborough | 167,983 | 600 | 103,445 | 64,538 | Scarborough | Keele Valley | 22 |
| Symes | 100,166 | 390 | 94,473 | 5,693 | York<br>Toronto | Keele Valley | 20 |
| Victoria Park | 120,235 | 460 | 88,910 | 31,325 | North York<br>Scarborough | Brock West | 17 |
| Totals | 1,241,523 | | 857,442 | 384,081 | | | 135 |

Source: SWEAP, Solid Waste Management Base Year 1986, February 1988.
(a) operated by a private firm in 1986 on behalf of MOE
(b) personal communication with Metro Toronto staff

Table 4.10
TRANSFER STATION GENERIC CAPITAL COSTS

| Design | Capacity (t/yr) | Capacity (t/day) | Tip Floor (m3) | Facility | Capital Costs | | Operating Costs | | Haulage Costs |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Peel ($000/t) | Metro ($000/t) | Peel ($/t) | Metro ($/t) | 30-60 km ($/t) |
| 1 bay | 65,000 | 250 | 1,100 | no building | 1,296 | | 5 | 10 | 11 to 14 |
| | | | | building | 2,500 | 3,000 | | | |
| 3 bay | 200,000 | 800 | 4,200 | no building | 2,750 | | 3.5 | 7 | 11 to 14 |
| | | | | building | 5,250 | 8,000 | | | |
| 5 bay | 300,000 | 1,200 | 8,000 | no building | 3,500 | | 3.25 | 6.5 | 11 to 14 |
| | | | | building | 8,250 | 12,000 | | | |

Source: MacLaren in-house files.

Transfer station tipping fees in Metro Toronto somewhat higher than landfill tipping fees, at approximately $115/tonne (June 1990) and $175/tonne (1991).

**Transfer Station Operating and Capital Costs**

Municipalities have made little effort to compile information on the costs associated with transfer stations. In the cases of Simcoe County and Metro Toronto, figures were reported for "total cost" for a number of facilities. It could not be ascertained from the WMMPs, however, what this total cost figure truly represented. Since no assumptions can be made regarding these numbers, they have been reported in the database but not analyzed.

MacLaren transfer station design experience and in-house files were used to develop generic capital and operating costs for transfer stations. Table 4.10 presents capital, operating and haulage costs for transfer stations as a function of the size of the facility. Table 4.11 presents haulage costs from a number of facilities in units of dollars per tonne-minute of operation.

Cost curves prepared by MacLarens for capital and operating costs are presented in Figures 4.6 and 4.7.

**Table 4.11**
**TRANSFER STATION HAULAGE COSTS**

| Source | Haul Costs $/Tonne*Minute |
|---|---|
| Peel Master Plan<br>Stage 3 Final Report | 0.076 (1989) |
| Ingram Drive Transfer Station | 0.058 (1989) |
| Halton Region<br>Walker Brothers<br>Occidental Chemical | 0.090 (1990)<br>0.092 (1990) |

Source: MacLaren in-house files.

### 4.4.4 Future Trends

As landfilling trends move towards the development of more regionalized facilities, transfer stations will play an increasingly important role in waste management systems. Although it is still early to predict trends, transfer stations for recyclable materials can be anticipated. The regionalized nature of material recycling facilities may make such transfer stations feasible for economic reasons.

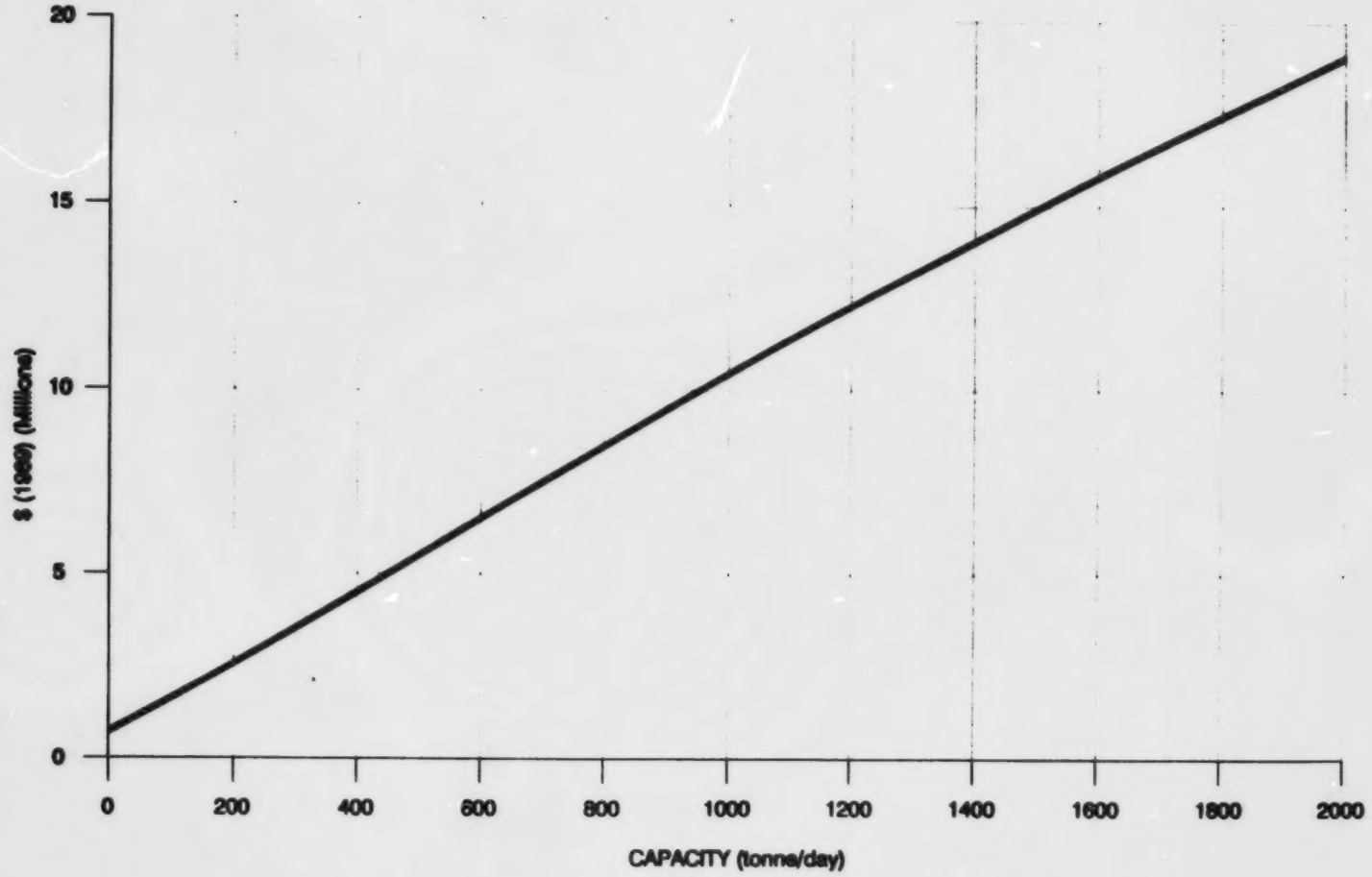



**Figure 4.6**
**TRANSFER STATION CAPITAL COST**

**Ref: MacLaren Engineers,**
**Waste Management Study For**
**Region of York, 1989**

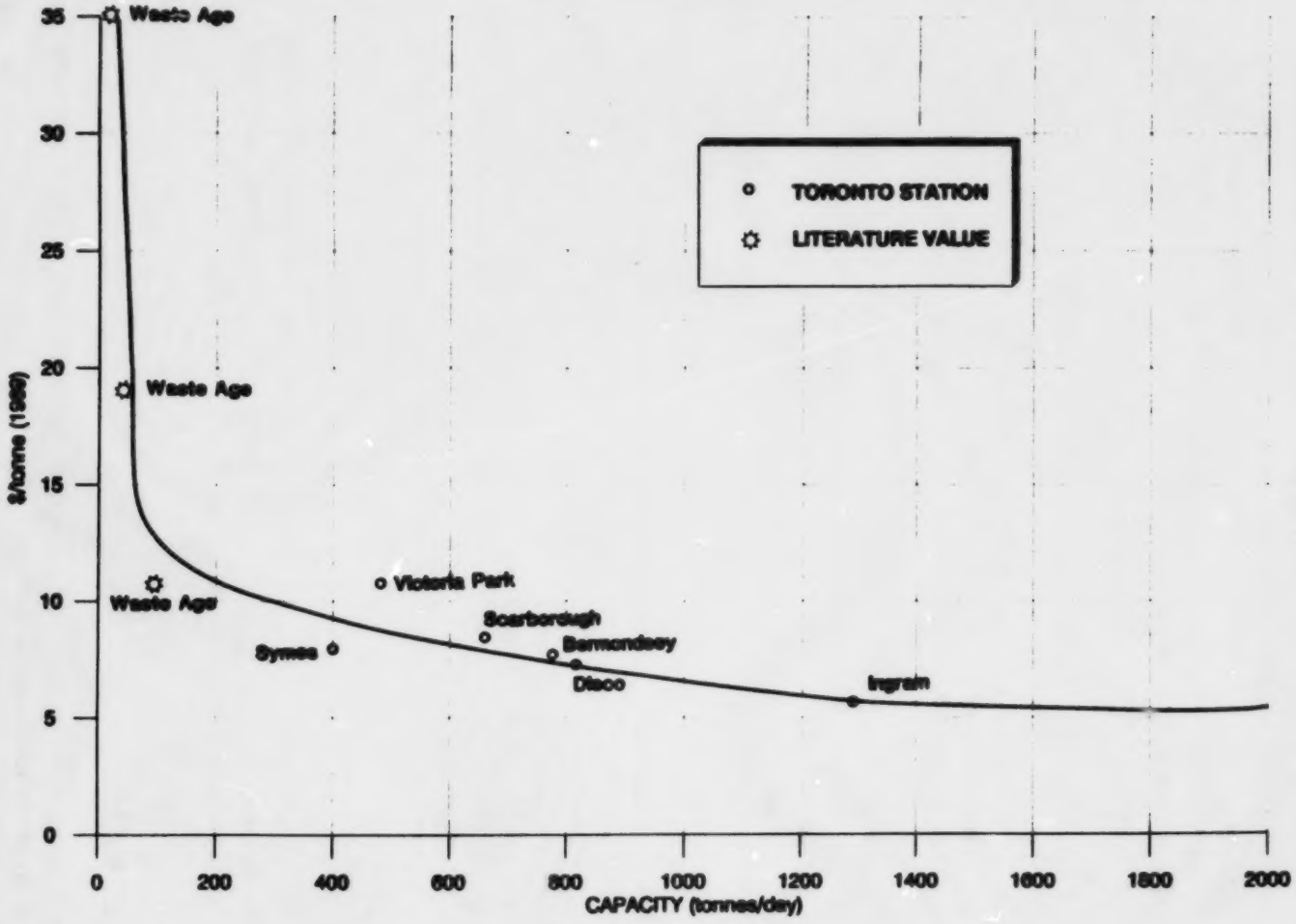



**Figure 4.7**
**TRANSFER STATION OPERATING COST**

**Ref: MacLaren Engineers,**
**Waste Management Study For**
**Region of York, 1989**

## 4.5 HAULERS

### 4.5.1 General Description of Industry

The solid waste collection and transport industry in Ontario can be divided into two main groups. Traditionally, all such services were performed by the municipality, and in some cases, this remains true today. However, in recent years, many municipalities have begun to contract hauling work to the private sector in the belief that costs will decrease and efficiency will improve. Resistance to this trend has been expressed by public sector labour unions and there remains a mix of approaches to municipal solid waste hauling at the present time.

Data on private sector haulers in Ontario came from three different sources. The principal sources were the 1990 Ontario Waste Management Association members listing and Dun & Bradstreet data on SIC 4953, Refuse Systems, which includes establishments engaged in collection of garbage. The information provided by Dun & Bradstreet includes the results of a telephone survey designed and conducted for this study.

The third data source is the Carriers Database provided in hardcopy format to the study team by the MOE's Approvals Branch. Unfortunately, it has not been possible to reconcile these various sources of information since slight differences in company names and locations make identification of duplicates impossible. Thus each source of information has been examined separately and the results are discussed in the following subsections.

Data collection for public sector haulers focused on employment in Metropolitan Toronto where the majority of public sector hauling takes place and where it remains the most common practice.

Several different types of trucks are common to the hauling industry in Ontario. These are described briefly below. Some have been developed to meet the specific needs of curbside recycling programs.

**Front Loading Packer Truck**

Fitted with hydraulic hoists to lift metal disposal bins over the front end of the truck and tip them into the top of the container. Separate hydraulic equipment for compacting the waste is also used.

**Rear Loading Packer Truck**

Container is open at the rear and fitted with hydraulic compaction equipment. Waste is lifted manually to the opening.

**Side Loading Packer Truck**

Container is open at the top. Hydraulic lifting equipment at the side is designed to lift molded plastic waste containers (residential size) and tip them into the top. Again, compaction equipment is used.

**Roll Off Truck**

For large volume, usually industrial, wastes which are not readily compacted. Large disposal bins are mounted on the truck trailer, and rolled off at the customer's site using hydraulic hoists. Thus the entire container is left on-site until removal is required. At that time, the entire container is lifted back onto the truck trailer and removed.

**Push-out Transfer Trailers**

Large trailers commonly used for transporting waste from transfer stations to disposal sites. Large volume containers can accommodate approximately five times the volume of the packer trucks commonly used for collection and transport to transfer stations. In this way, the number of truck movements to the disposal site is reduced. When being loaded, waste is compacted with transfer station equipment. For unloading, hydraulic equipment is used to push waste out of the rear opening.

**Closed Body Compartmentalized Top Loading Trucks**

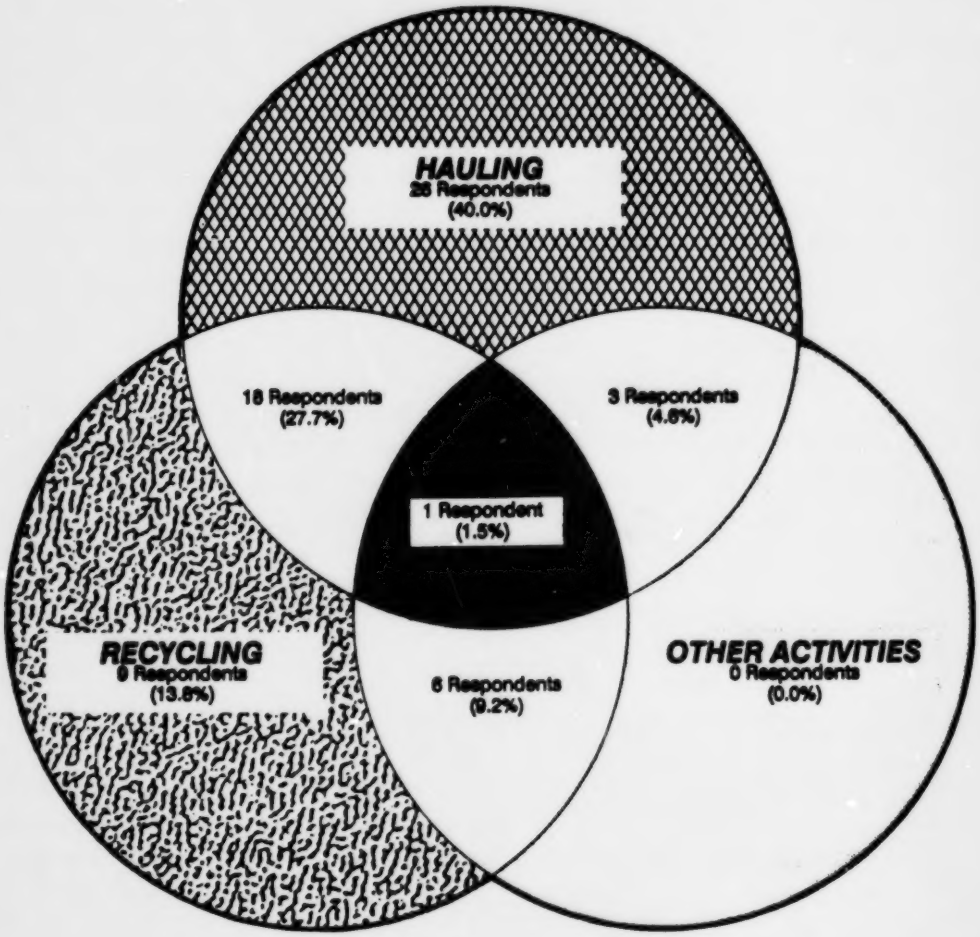
Commonly used in curbside recycling. Hydraulic lifts along the side of the truck are used to lift items to the top, where each is tipped into its own compartment. This achieves some degree of sorting of Blue Box items at the curbside.

**Closed Body Compartmentalized Side Loading Trucks**

Open-sided truck used in curbside recycling. Separate compartments for recyclables are loaded manually.

### 4.5.2 Physical Dimensions

The major source of information on private sector haulers of solid waste was a telephone survey conducted by Dun&Bradstreet (D&B) under a subcontract to this study.




NOTES:

- Diagram not to scale, used for illustrative purposes only.
- Data indicate that (2) respondants (3.1%) did not answer questions regarding business activities

**Figure 4.8**
**BUSINESS ACTIVITIES OF SURVEY RESPONDENTS**

The purpose of the survey was to supplement data on physical and economic dimensions available from an already existing D&B database on all SIC groups. A questionnaire was designed by CH2M HILL for the purposes of the survey, a copy of which can be found in Appendix B.

The SIC group of interest in identifying haulers was 4953 (Refuse Systems) which includes those companies engaged in the collecting of garbage. The D&B file on this SIC contains 295 companies in Ontario but includes a wide range of business activities, from landfill operation to dead animal removal. Therefore the first question of the telephone survey asked respondents to define their activities. This also identified recycling agents who are part of this SIC. The results of that aspect of the survey are discussed in Section 5.4. Figure 4.8 gives a breakdown of the activities of survey respondents. The majority of respondents (73.8%) are involved in hauling, but nearly half of these (33.8% of the total) are also involved in recycling or other activities.

The following summarizes the survey response rate:

- 295 companies were on the original list
- 65 (22%) completed the survey.
- 18 (6%) were contacted but refused to complete the survey.
- 55 (19%) were disqualified by Question 1 regarding solid waste handling or recycling activities.
- 42 (14%) of the telephone numbers reached were no longer in service, or the company was no longer in business.
- 45 (15%) of the records were duplicates (e.g., head and regional offices of the same companies). Where possible, responses were sought from head offices.
- 70 (24%) of the companies were not contacted, despite the fact that 3 to 5 calls were placed.

Existing data on companies that did not respond to the survey were provided separately and are discussed at the end of this subsection. The following discussion pertains to those companies responding to the survey.

Existing data on the 65 companies surveyed included employment. For all companies involved in hauling, regardless of any additional activities, 47 of 48 companies (98%) reported employment totalling 792.

Amounts of solid waste *hauled and disposed* in Ontario were solicited. Forty six respondents reported a total 109,297,213 tonnes annually, with one respondent reporting 80,000,000 tonnes and a second reporting 12,000,000 tonnes. CH2M HILL tried unsuccessfully to recontact these companies to clarify their answers. These two responses will be ignored, and limited value is placed on some other responses on waste quantities, as the total quantity of waste generated in the Province is less than 10 million tonnes annually.

Figure 4.9 presents a distribution of the survey respondents by amount of waste reported to be hauled and disposed. It is speculated that the actual distribution of all firms is even further skewed towards small firms since these are more likely to be missed by a database such as the one maintained by Dun&Bradstreet.

An additional question solicited amounts of *recyclable materials hauled* in Ontario. Forty four respondents reported a total of 81,368,991 tonnes annually. The same respondent as previously discussed reported that he hauled 80,000,000 tonnes of material to recycling. It appears that some respondents are reluctant to divulge accurate information on issues related to their market position. This study determined that a total of 486,200 tonnes of material are recycled in Ontario, hence some reported responses to this question are of limited value.

Figure 4.10 presents a distribution of the number of firms by amount of recyclable materials hauled. Once again some of the reported data are inaccurate, and a disproportionately high number of the smaller firms may have been missed in this sampling.

Respondents were asked to name up to ten municipalities served. Results are summarized in Table 4.12. In general, larger municipalities have a larger number of haulers. As expected, some smaller municipalities in the Greater Toronto Area, for example, Newcastle, have a disproportionately high number of haulers.

The sources of solid waste hauled in the private sector in Ontario were also identified. Figures 4.11 to 4.13 present the distribution of the fraction of residential, industrial and commercial sources of solid waste hauled by the private sector in Ontario.

The distributions of the reported prices charged for hauling solid waste from each of these sectors are presented in Figures 4.14 to 4.16. The majority of respondents provided no pricing information. Again, it is assumed that companies felt that pricing information was sensitive. The remaining reported prices are approximately evenly distributed. Unfortunately, however, relatively few respondents reported a price in the appropriate units and it is not clear whether the distributions of Figures 4.14 to 4.16 are truly representative. Because of the competiveness of the haulage industry it is not surprising that haulers would be reluctant to disclose pricing information which might impact on their competitive edge. No further statistical measures, such as arithmetic mean, were calculated for this reason.

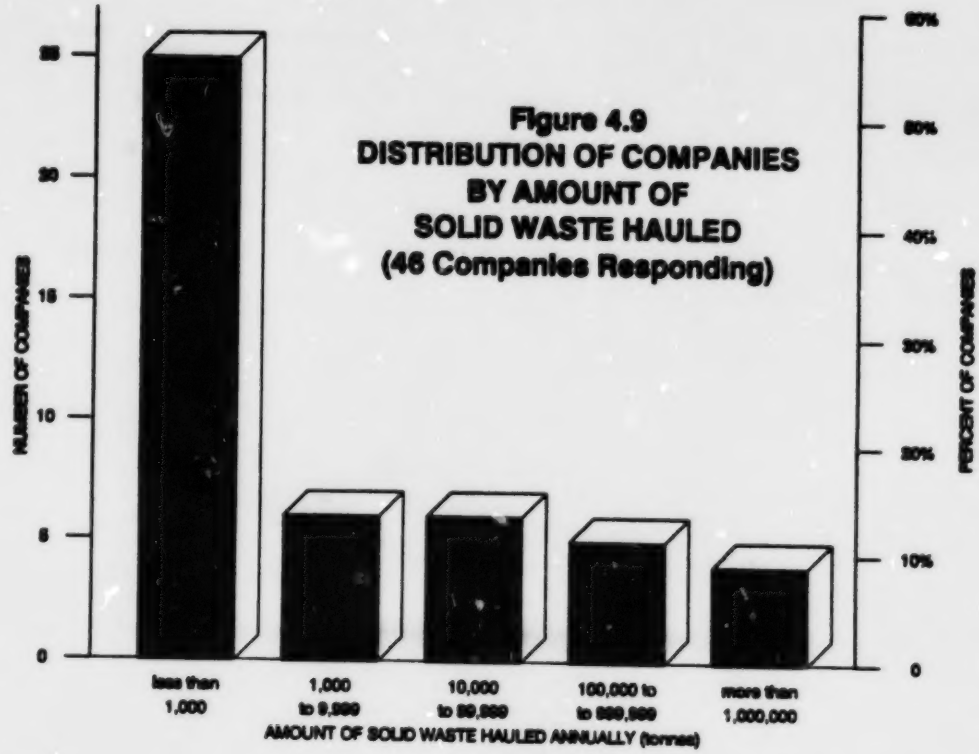



**Figure 4.9**
**DISTRIBUTION OF COMPANIES BY AMOUNT OF SOLID WASTE HAULED (46 Companies Responding)**

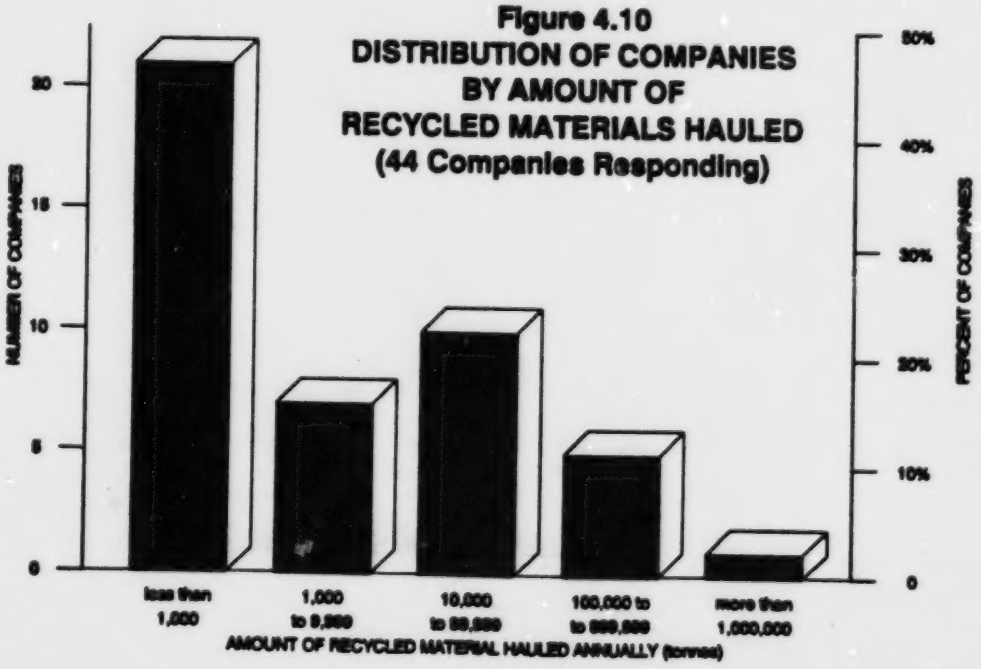



**Figure 4.10**
**DISTRIBUTION OF COMPANIES BY AMOUNT OF RECYCLED MATERIALS HAULED (44 Companies Responding)**

**Table 4.12**
**SUMMARY OF MUNICIPALITIES SERVED BY HAULERS IN ONTARIO WHO RESPONDED TO SURVEY**

| Municipality | Number of Haulers Reporting Service |
|---|---|
| Ajax | 6 |
| Barrie | 3 |
| Belleville | 2 |
| Brampton | 8 |
| Brantford | 1 |
| Burlington | 2 |
| Caledon | 2 |
| Cambridge | 2 |
| Chatham | 1 |
| Cornwall | 4 |
| East York | 1 |
| Etobicoke | 5 |
| Guelph | 1 |
| Halton Hills | 3 |
| Hamilton | 4 |
| Kanata | 1 |
| Kingston | 2 |
| Kingston Township | 1 |
| Kitchener | 2 |
| London | 3 |
| Markham | 1 |
| Milton | 2 |
| Mississauga | 12 |
| Nepean | 1 |
| Newcastle | 6 |

**Table 4.12**
**SUMMARY OF MUNICIPALITIES SERVED BY HAULERS IN ONTARIO WHO RESPONDED TO SURVEY**

| Municipality | Number of Haulers Reporting Service |
|---|---|
| Newmarket | 1 |
| Niagara Falls | 1 |
| North Bay | 1 |
| North York | 4 |
| Oakville | 8 |
| Oshawa | 8 |
| Ottawa | 3 |
| Peterborough | 2 |
| Pickering | 5 |
| Richmond Hill | 3 |
| Sarnia | 1 |
| Sault Ste. Marie | 1 |
| Scarborough | 3 |
| St. Catharines | 2 |
| Stoney Creek | 2 |
| Sudbury | 3 |
| Timmins | 1 |
| Toronto | 17 |
| Vaughan | 3 |
| Waterloo | 1 |
| Windsor | 2 |
| Welland | 1 |
| Whitby | 4 |
| York | 1 |
| Other | 6 |

In many cases, prices, were: reported in units which could not be easily converted to $/tonne (eg, $/load); reported as a range; or, simply commented upon (eg, "price depends on contract"). The database of raw data responses has a code to indicate where this occurred.

Figures 4.17 to 4.19 summarize the distributions of the fraction of commercial, industrial and residential sources for the hauling of recyclable materials. Interestingly, these distributions are more clearly weighted in favour of commercial and industrial sources than are the distributions for hauling of solid waste (Figures 4.11 to 4.13).

Information on equipment in use by private sector haulers was also solicited. It would appear that relatively few haulers responded to these questions, but the available information in summarized in Tables 4.13 to 4.19.

**Table 4.13**
**SUMMARY OF INFORMATION ON CLOSE BODY COMPARTMENTALIZED TOP LOADING TRUCKS**

| Size | Number of Companies Reporting Use |
|---|---|
| 31 to 50 cubic yards | 5 |
| 21 to 30 cubic feet | 1 |
| 31 plus cubic feet | 1 |
| lees than 10 tons | 1 |
| 10 to 20 tons | 1 |
| Total Reported Number in Use | 75 |

**Table 4.14**
**SUMMARY OF INFORMATION ON CLOSED BODY COMPARTMENTALIZED SIDE LOADING TRUCKS**

| Size | Number of Companies Reporting Use |
|---|---|
| 21 to 30 cubic yards | 1 |
| 31 to 50 cubic yards | 2 |
| 31 plus cubic feet | 1 |
| less than 10 tons | 1 |
| Total Reported Number in Use | 121 |

**Table 4.15**
**SUMMARY OF INFORMATION ON FRONT LOADING PACKER TRUCKS**

| Size | Number of Companies Reporting Use |
|---|---|
| 21 to 30 cubic yards | 2 |
| 31 to 50 cubic yards | 5 |
| 31 plus cubic feet | 1 |
| Total Number Reported in Use | 81 |

**Table 4.16**
**SUMMARY OF INFORMATION ON REAR LOADING PACKER TRUCKS**

| Size | Number of Companies Reporting Use |
|---|---|
| 15 to 20 cubic yards | 5 |
| 21 to 30 cubic yards | 9 |
| 50 plus cubic yards | 1 |
| 31 plus cubic feet | 1 |
| less than 10 tons | 1 |
| 10 to 20 tons | 2 |
| Total Number Reported in Use | 126 |

**Figure 4.11**
**DISTRIBUTION OF COMPANIES BY FRACTION OF COMMERCIAL WASTE**

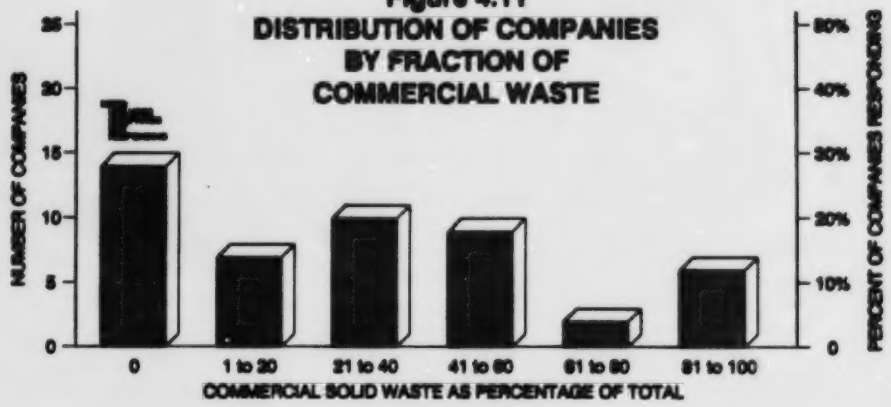



**Figure 4.12**
**DISTRIBUTION OF COMPANIES BY FRACTION OF INDUSTRIAL WASTE**

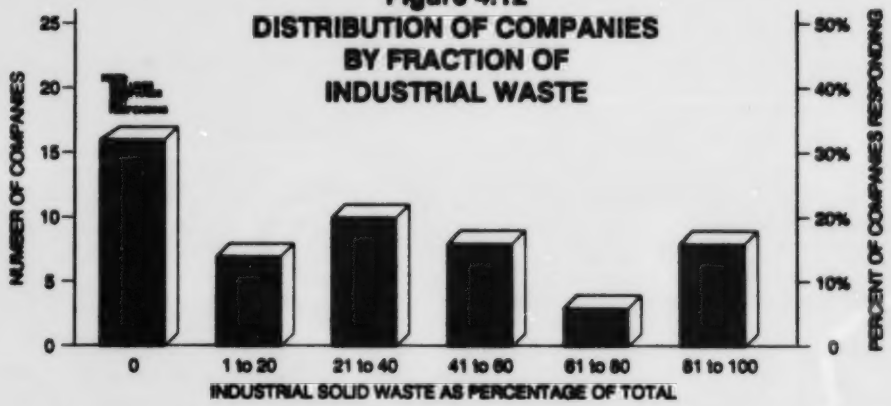
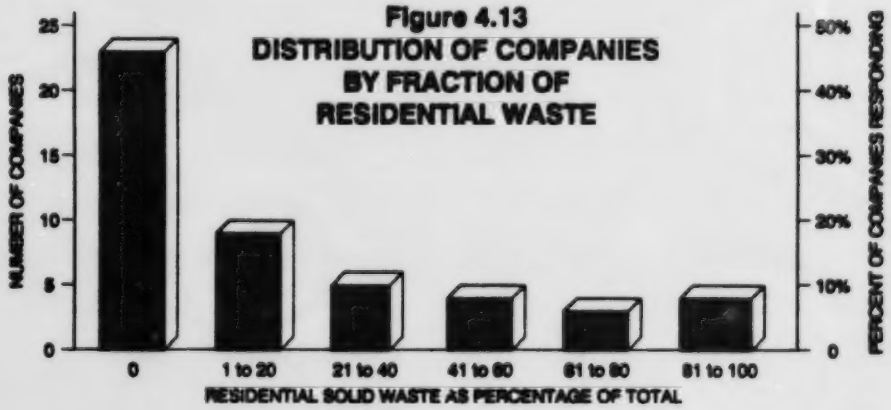



**Figure 4.13**
**DISTRIBUTION OF COMPANIES BY FRACTION OF RESIDENTIAL WASTE**




*NOTE:*
- *FOR FIGURES 4.11, 4.12, & 4.13, PERCENTAGES ARE BASED ON 48 RESPONSES, 3 OF WHICH DID NOT REPORT NUMBERS TOTALLING 100%*
- *COMPANIES NOT RESPONDING ARE SHOWN IN ZERO COLUMN IN ALL CASES.*

**Figure 4.14**
**DISTRIBUTION OF COMPANIES**
**BY PRICES CHARGED**
**FOR HAULING COMMERCIAL WASTE**
**(22 Companies Responding)**

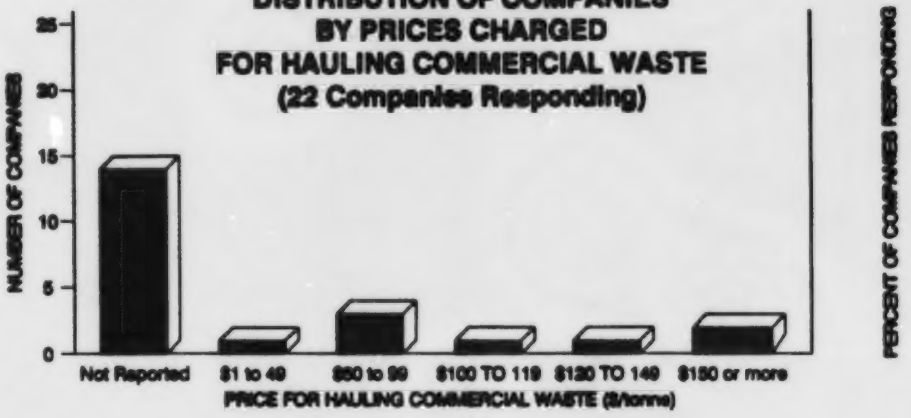



**Figure 4.15**
**DISTRIBUTION OF COMPANIES**
**BY PRICES CHARGED**
**FOR HAULING INDUSTRIAL WASTES**
**(28 Companies Responding)**

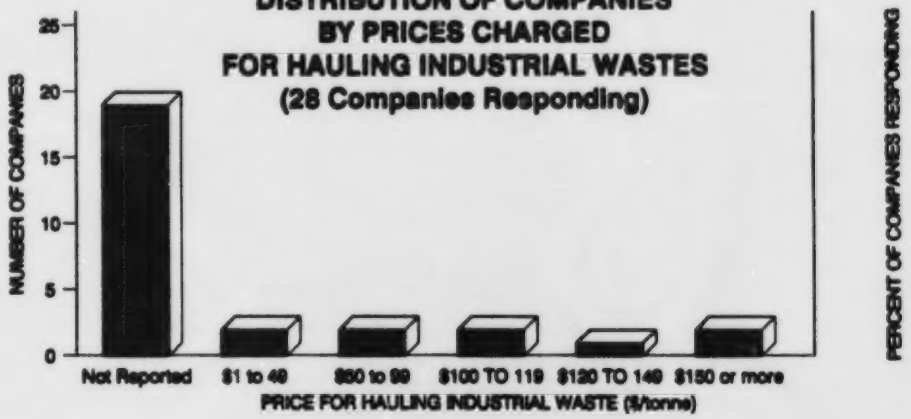



**Figure 4.16**
**DISTRIBUTION OF COMPANIES**
**BY PRICES CHARGED**
**FOR HAULING RESIDENTIAL WASTE**
**(29 Companies Responding)**

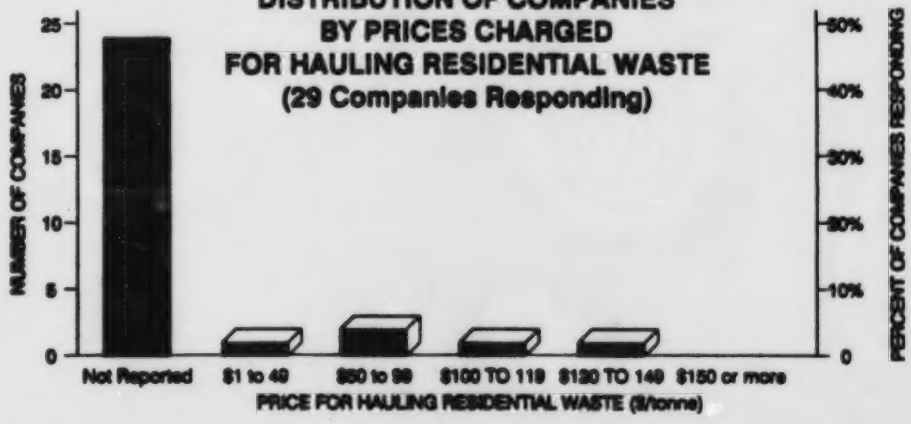


**Figure 4.17**
**DISTRIBUTION OF COMPANIES BY FRACTION OF COMMERCIAL RECYCLED MATERIALS HAULED (48 Companies Responding)**

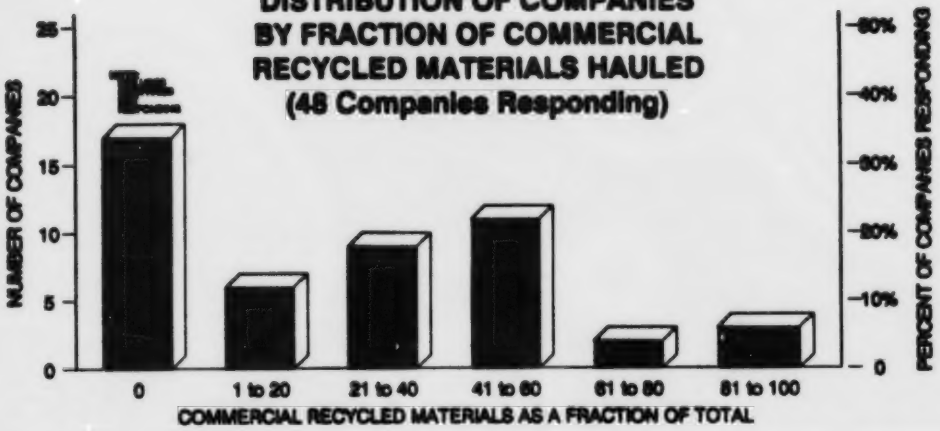



**Figure 4.18**
**DISTRIBUTION OF COMPANIES BY FRACTION OF INDUSTRIAL RECYCLED MATERIALS HAULED (48 Companies Responding)**

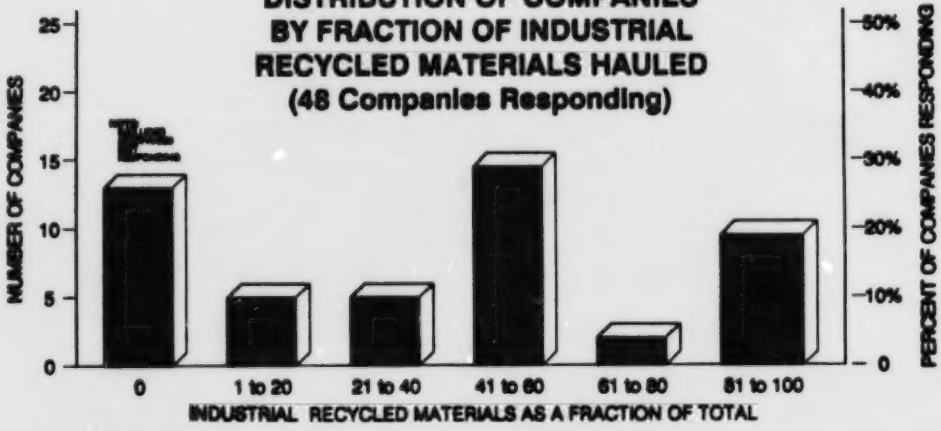
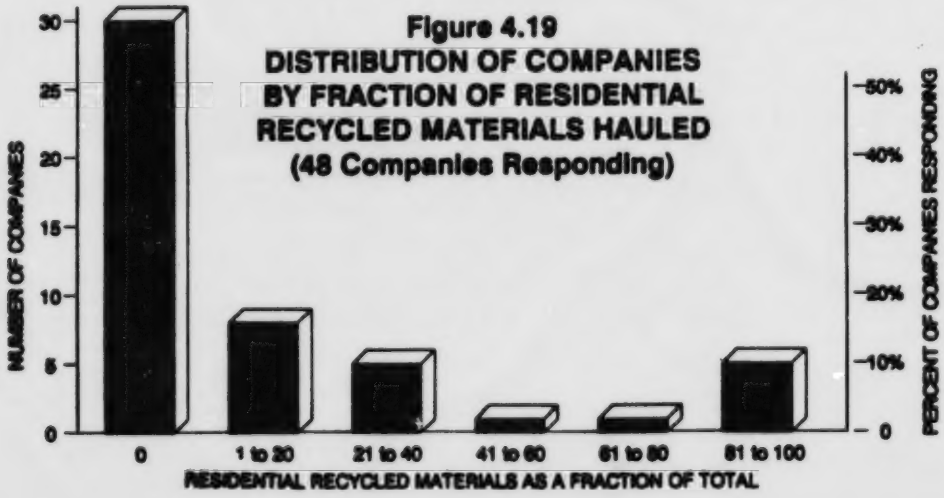



**Figure 4.19**
**DISTRIBUTION OF COMPANIES BY FRACTION OF RESIDENTIAL RECYCLED MATERIALS HAULED (48 Companies Responding)**



| Table 4.17<br>SUMMARY OF INFORMATION ON SIDE LOADING PACKER TRUCKS | |
|---|---|
| **Size** | **Number of Companies Reporting Use** |
| 15 to 20 cubic yards | 3 |
| 21 to 30 cubic yards | 1 |
| 31 plus cubic yards | 1 |
| 21 plus tons | 1 |
| Total Number Reported in Use | 5 |

| Table 4.18<br>SUMMARY OF INFORMATION ON ROLL OFF TRUCKS | |
|---|---|
| **Size** | **Number of Companies Reporting Use** |
| Less than 15 cubic yards | 1 |
| 21 to 30 cubic yards | 2 |
| 31 to 50 cubic yards | 6 |
| 31 plus cubic feet | 1 |
| Less than 10 tons | 3 |
| 10 to 20 tons | 2 |
| 21 plus tons | 5 |
| Total Number Reported in Use | 284 |

| Table 4.19<br>SUMMARY OF INFORMATION ON OTHER TRUCKS | |
|---|---|
| Size | Number of Companies Reporting Use |
| Less than 15 cubic yards | 3 |
| 21 to 30 cubic yards | 1 |
| Less than 10 tons | 1 |
| 10 to 20 tons | 2 |
| Less than 3,500 gallons | 2 |
| 3,500 plus gallons | 1 |
| Total Number Reported In Use | 967 |

Existing D&B database information on the 230 companies which did not respond to the survey was also obtained. Note, however, it is not necessarily possible to ascertain from this information whether any particular firm is involved in hauling. Of these 230, 54 indicated their primary occupation was garbage collection or trucking, while an additional 91 described their main activity as refuse systems, which presumably may include waste hauling. Table 4.20 summarizes information on employment under both of these activities.

| Table 4.20<br>SUMMARY OF EMPLOYMENT FOR COMPANIES NOT SURVEYED | | | | |
|---|---|---|---|---|
| Primary Activity | Number of Companies | Number of Companies Reporting Employment | Percentage of Companies Reporting Employment | Total Reported Employment |
| Garbage Collection or Trucking | 54 | 54 | 100 | 1,383 |
| Refuse Systems | 91 | 89 | 98 | 594 |

It is interesting to note that only two of the 230 companies not surveyed listed Scrap and Waste Material Wholesale (SIC 5093) as a secondary activity. Many of the 230 companies were branch offices of some of the large hauling companies in Ontario. Nine of the listings were for BFI (Browning-Ferris Industries Ltd.), eleven were for Laidlaw Waste Systems Ltd., and seven were for Tricil Limited.

The database of Ontario Waste Management Association member information has 123 records. Information from the Association indicates that together these haulers handle more than 85% of the province's solid waste. 98 of these companies report hauling of residential and ICI solid waste. Of these, 69 (70%) haul both residential and ICI, 70 (71%) haul residential and 97 (99%) haul ICI. Eleven (11%) own and/or operate landfills, 14 (14%) own and/or operate transfer stations, and 43 (44%) are involved in recycling. Tricil of Sarnia (now owned by Laidlaw Waste Systems Limited) owns and operates an incinerator for destruction of liquid and hazardous wastes only.

The MOE Approvals Branch Carriers Database lists haulers holding MOE Certificates of Approval (C of A). Information includes C of A number, type of wastes handled and which of six MOE provincial regions are served. It thus may contain many companies which carry, for example, only liquid industrial or hazardous waste and do not carry municipal solid waste. However, since these data were not available in electronic format to the study team, no further analysis was possible. The database appears to contain more than 3,000 records, however, once again it was not possible to ascertain whether the same company may hold more than one C of A, nor whether the listing contained duplicates.

Some municipalities still maintain their own staff and equipment to collect and haul solid waste. In Regional Municipalities, collection is the responsibility of the municipality, while disposal is under regional jurisdiction. A telephone survey of Metropolitan Toronto municipalities was conducted to establish typical staffing requirements. Results are summarized in Table 4.21.

### 4.5.3 Economic Dimensions

Annual sales figures for twenty nine (29) haulers totalled $54,567,500 in the database of existing data from Dun&Bradstreet. However, since many haulers are also involved in other activities, the survey solicited information on what fraction of sales were attributed to hauling. Figure 4.20 presents the distribution of responses.

In addition, responses were sought as to what fraction of business is conducted in Ontario. These results appear in Figure 4.21.

**Table 4.21**
**SUMMARY OF SELECTED MUNICIPAL EMPLOYMENT FIGURES FOR SOLID WASTE COLLECTION AND HAULAGE**

| Municipality | Garbage (Perm) | Recycling (Perm) | Other (Perm) | Other (Temp) | Total (Perm) | Total (Temp) |
|---|---|---|---|---|---|---|
| East York | 45 | 10 | | | 55 | |
| Etobicoke | | | | | 106 | 10 |
| North York | 165 | 24 | 14 | | 203 | |
| Scarborough | 114 | 26 | | 18* | 140 | |
| Toronto | | | | | 400 | |
| York | | | | | 60 | |

* These 18 employees work for a private company contracted to Scarborough to provide "on-call" staffing.

A distribution of operating costs was also developed (Figure 4.22).

Again, information on the companies not surveyed is also available. Haulers may fall under a number of categories in this SIC, including Garbage Collection and Refuse Systems. Sales figures for these categories are summarized in Table 4.22.

**Table 4.22**
**SUMMARY OF ANNUAL SALES FIGURES FOR COMPANIES NOT SURVEYED**

| Primary Activity | Number of Companies | Number of Companies Reporting Sales Figure | Percentage of Companies Reporting Sales Figure | Total Reported Sales Figures |
|---|---|---|---|---|
| Garbage Collection or Trucking | 54 | 15 | 28 | $36,338,900 |
| Refuse Systems | 91 | 39 | 43 | $11,949,600 |

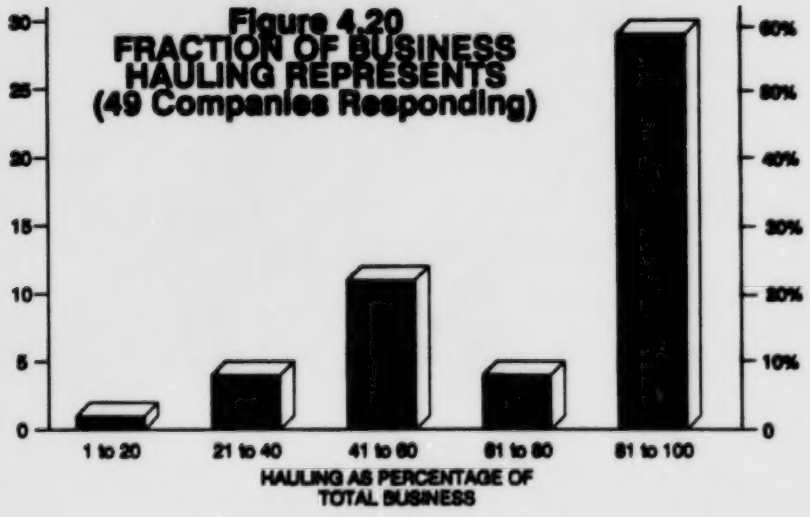



**Figure 4.20**
**FRACTION OF BUSINESS HAULING REPRESENTS (49 Companies Responding)**

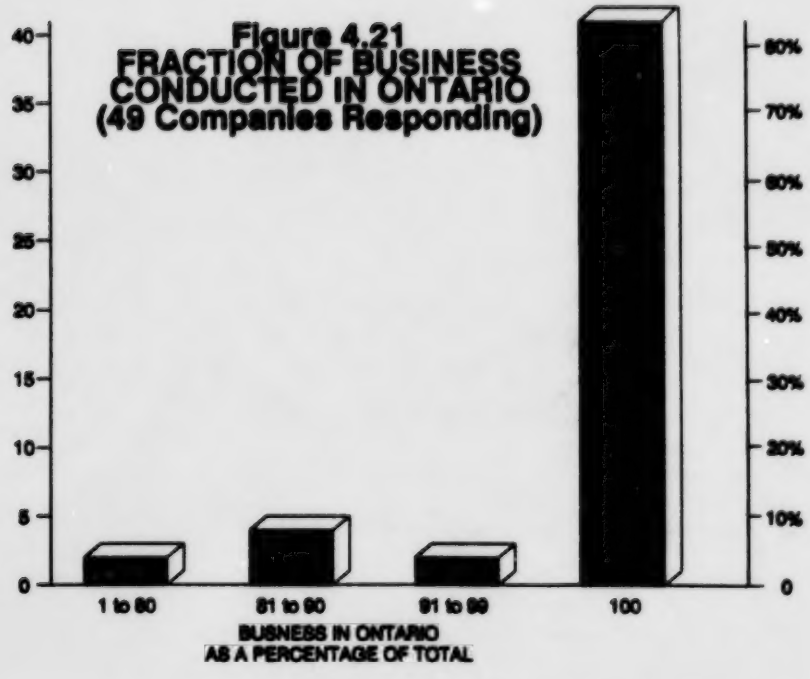



**Figure 4.21**
**FRACTION OF BUSINESS CONDUCTED IN ONTARIO (49 Companies Responding)**

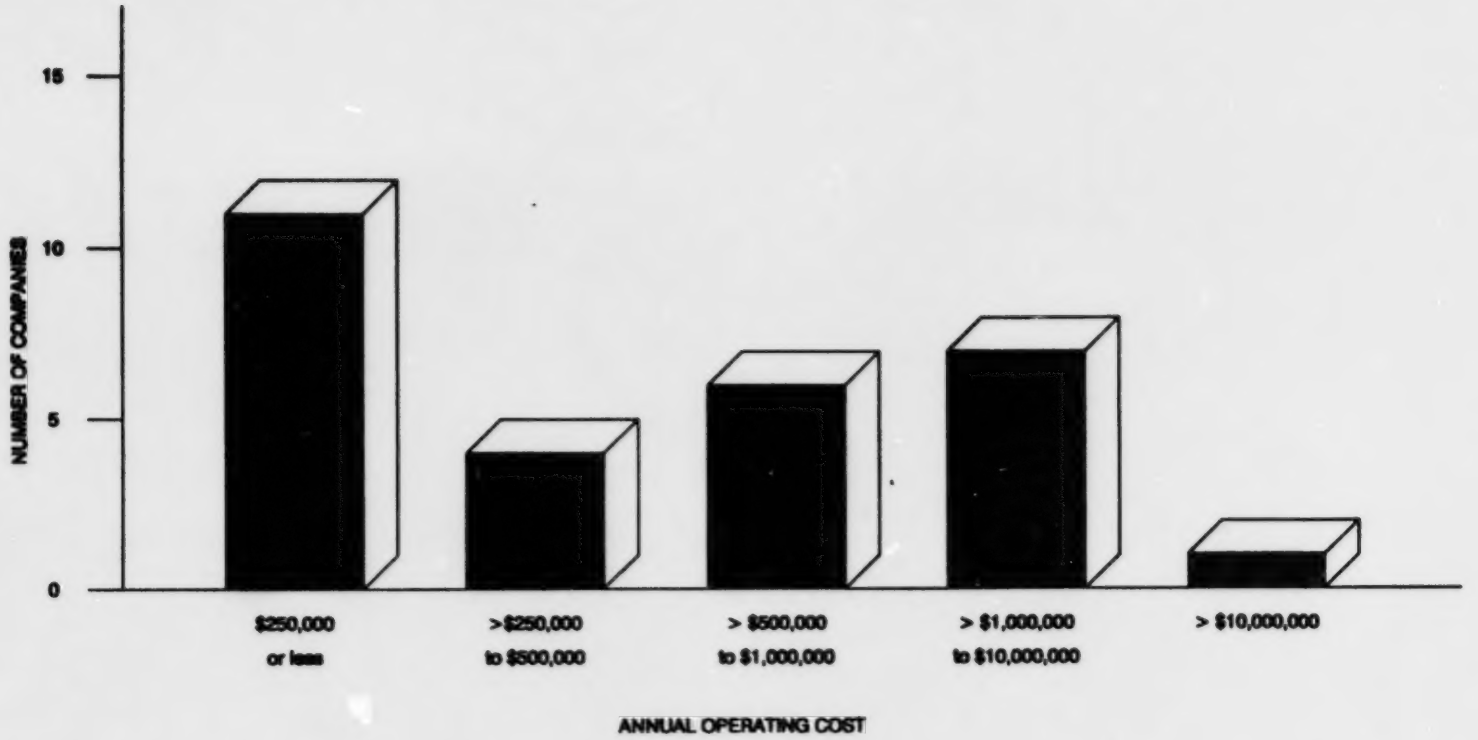



**Figure 4.22**
**DISTRIBUTION OF COMPANIES BY ANNUAL OPERATING COSTS (29 Companies Responding)**

### 4.5.4 Future Trends

In general, it is difficult to generalize on future trends in the hauling business since they will be highly dependent on policy initiatives related to reduction/reuse/recycling strategies. For example, if the focus of policy is waste reduction, the total amount of waste requiring handling may decrease, resulting in decreased hauling. On the other hand, if recycling activities continue to increase, so-called double handling of wastes may increase as they are moved between generators, various recycling agents and the end user, resulting in increased hauling.

Two questions in the telephone survey addressed respondents' opinions of future trends in the hauling business. It should be noted that responses to such questions tend to be somewhat overly optimistic, but they do serve to reflect the overall business climate.

**Question 4 read:**

In the future, as more waste reduction, reuse of materials and recycling programs are implemented, how do you see the growth of your business? Do you think your business will have:

1) Substantial growth
2) Slight growth
3) Stay the same
4) Slight loss of business
5) Substantial loss of business

Figure 4.23 summarizes the forty nine responses received in pie chart form. More than 70% of haulers expect slight or substantial growth in the future. Less than 15% expect any losses.

**Question 5 read:**

In the future, as more waste reduction, reuse of materials and recycling programs are implemented, how do you see your company's costs changing? Do you think your business costs will have:

1) Substantial increase
2) Slight increase
3) No change
4) Slight decrease
5) Substantial decrease

Figure 4.24 presents a pie chart representing the forty nine responses. Nearly two-thirds of all respondents believe that haulage costs are likely to increase with new policy initiatives. Notably, however, a total of more than 20% anticipate lower costs.

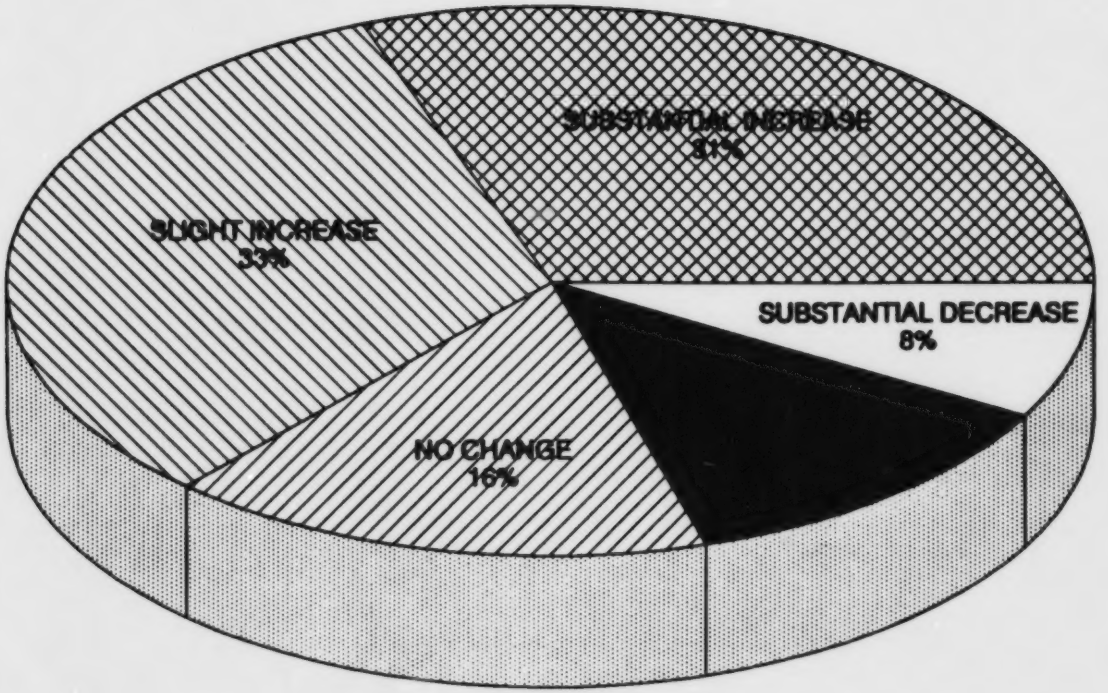



**Figure 4.23**
**ANTICIPATED BUSINESS COSTS**

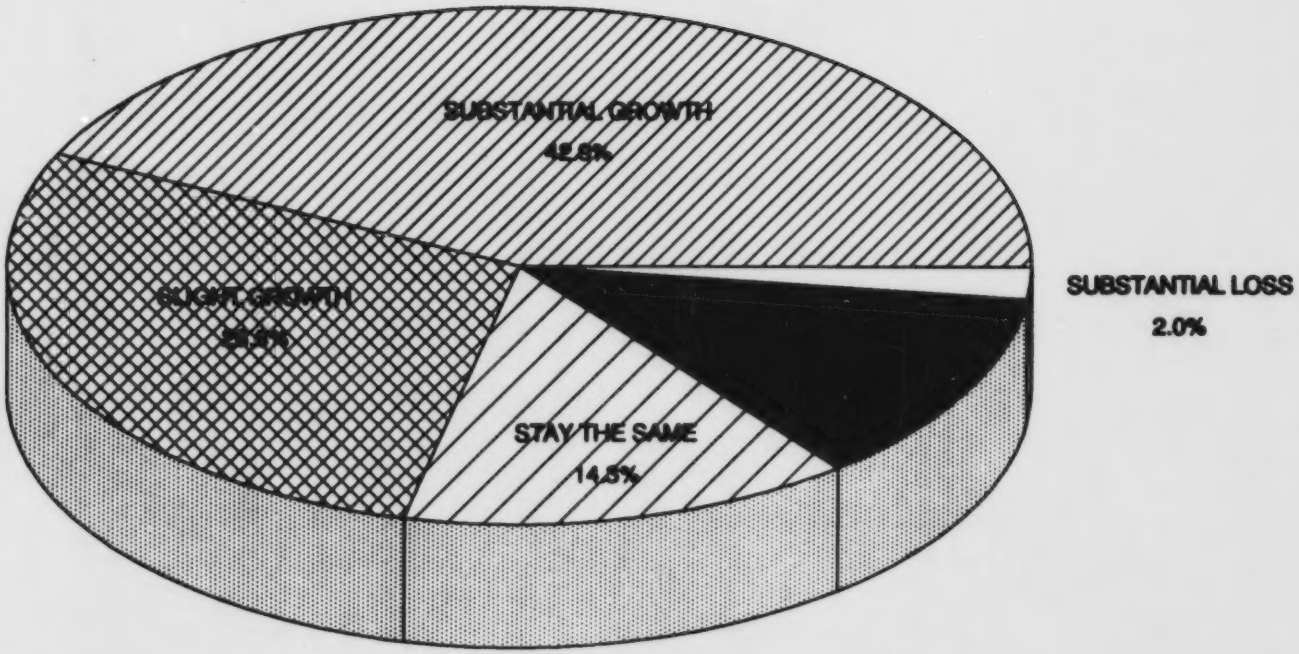



**Figure 4.24**

**ANTICIPATED BUSINESS GROWTH**

## 4.6 ENVIRONMENTAL PROTECTION INDUSTRY

### 4.6.1 General Description of Industry

A report to the Ministry of the Environment on the Environment Protection Industry in Ontario was completed by Woods Gordon in May 1989. The industry was reported to employ 28,000 people in 1,700 firms in the Province. The broadly defined sector includes the following twelve categories:

1) Consulting/engineering
2) Air pollution control equipment
3) Water pollution control equipment
4) Other pollution control equipment
5) Treatment chemicals
6) Solid waste handling
7) Liquid waste handling
8) Waste treatment and disposal
9) Laboratory
10) Recycling
11) Training
12) Biotechnology

Of these, only groups (1), (6), (8) and (10) would be of interest to the present study. The EPI study figures did not include municipal or government employees, and therefore did not cover the many people employed by municipalities to collect and recycle garbage, and to operate landfills, transfer stations and incinerators.

In any event, much of the physical and economic information required for this study on public, private and third sector solid waste management has been collected from other sources.

The EPI Sourcing Database created as part of the Woods Gordon study has been provided to the study team by the Ministry of Industry, Trade and Technology. It contains the listing of approximately 1,700 firms in the Ontario EPI as identified by Woods Gordon. It does provide some limited capabilities to search for information on the services provided, based on keywords. However, these searches appear to be of a type known as character or literal string searches, and, as such, no summary analysis of the data is possible in its present format. In addition, no information on the physical and economic dimensions of the companies are provided. Although the Woods Gordon report refers to economic spreadsheets developed to model the EPI, known as the Environmental Protection Impact Model, these are not contained in the database provided by MITT. For completeness' sake, the database of EPI companies is being included in the study database, even though it is not in dBASE format.

Possible alternative sources of information on the EPI are being developed by other government agencies. The agencies involved are:

1. Ministry of Industry, Trade and Technology (Ontario)

2. Industry, Science and Technology (Canada) - federal and regional offices

3. Statistics Canada - Environmental Statistics

4. Environment Canada - Solid Waste Management Branch

The following paragraphs summarize the current status of information gathering.

## 1. Ministry of Industry, Trade and Technology

Contact: David Reid, Domestic Industries, Environmental
(416) 324-6736

MITT are developing what is known as the Environmental Industries Sourcing Database. However, it is considered to be in the prototype stage only. In addition, much of the information is commercially confidential. Some aggregated data may be available at a future date, if formally requested, to provide an economic profile of the industries.

## 2. Industry, Science and Technology

Contact: Derek Yue, Toronto Regional Office
(416) 973-5159

IS&T (Ottawa) are working on the Environmental Industries (EI) Initiative. As such, regional offices have access to some initial results of a broad-ranging survey conducted by Corpus (Southam). This consists of an 80 page listing of company names for Ontario (approximately 1,600 names). However, this list is not specific to solid waste management and there is no company services listing included. Another responsibility of the EI Initiative is to improve Canadian SIC's to better reflect the EPI. The contact name in Ottawa is: John Moran, Chairman, Economic Characteristics Working Team, EI Initiative, (613) 954-6181.

The BOSS database system was also developed in Ottawa. It is available free from the Toronto Regional Office on floppy disk and was developed to serve manufacturers by providing a list of suppliers. It is updated periodically by mail-out survey. If a company fails to respond for three years, it is dropped from the listing. However, IS&T is hoping to expand this database because it is not comprehensive at this time.

## 3. Statistics Canada

Contact: Kirk Hamilton, Environmental Statistics
(613) 951-8585

StatsCan is in the process of drafting a survey which is to be partially funded by IS&T's EI Initiative. It addresses haulers and recycling agents in the private sector. The survey will be sent out sometime in November with data available around March 1991. A final published report would be expected sometime later in the spring.

The questions cover the following economic dimensions:

- Revenues for each of the activities (eg, hauling, disposing, hauling to a recycler, sorting, etc.).
- Operating cost structures (eg, fuel, labour, etc.).
- Number of employees.
- Quantities of materials (eg, hazardous, non-hazardous wastes, etc.).
- Fate of materials (eg, landfill, incineration, chemical or biological treatment, etc.).
- Quantities of materials recycled (eg, paper, aluminum, steel, etc.).
- Total investments.

The survey is being aimed at larger private firms throughout Canada. Data collected will be organized in a database format that will provide for provincial breakdowns where confidentiality allows.

A parallel survey of public sector waste management is now being discussed with the Public Institutions Division of StatsCan (contact: Rob Loggie - (613) 951-1809). This will provide for a comparable set of questions to the private sector survey described above, as well as names of private firms contracting to municipalities as a cross-reference to the private sector data. Data from that survey may be available at about the same time as the private sector survey.

## 4. Environment Canada

Information from MITT indicates that Environment Canada has conducted some EPI surveys through Dun & Bradstreet, however, the results may have been less than comprehensive. A possible contact there is: Dave Hay, Solid Waste Management Branch, (819) 953-1109.

### 4.6.2 Physical Dimensions

As noted above, the Woods Gordon study estimated the size of the entire EPI sector to be approximately 28,000 employees. This includes employment in the solid and hazardous waste, air quality and water and wastewater treatment areas, the latter two of which are not of interest to this study. Unfortunately, the study did not provide a breakdown of total employment for the solid and hazardous waste services sector. In the mail survey conducted for the study, 64 respondents in the solid and hazardous waste area accounted for a total of 2,738 employees.

The 1990 annual directory from the Ontario Waste Management Association provided a listing of equipment manufacturers and distributors. This information has been summarized in a database format (file name EQUIP.DBF), listing 44 companies. Company addresses and phone numbers as well as listings of the type of equipment supplied is provided. It should be noted that it appears that the majority of these companies are distributors only, and that very little manufacturing takes place in Ontario. However, no specific information of this nature is contained in the database. Nor is there any information on size of the companies (i.e. number of employees, etc.).

The industry journal Waste Age routinely publishes buyers' guides for various manufacturers of solid waste management equipment. These guides generally list only address and telephone number for the head office for each company. Thus branch manufacturing plants which may be located in Ontario are not included. Table 4.23 summarizes information from recent guides on numbers of manufacturers in total, in Canada and in Ontario. With the possible exception of curbside recycling containers, the vast majority of equipment is manufactured in the United States and is imported for distribution in Canada.

### 4.6.3 Economic Dimensions

The only source of economic information related specifically to the EPI was found in the Woods Gordon report. To briefly summarize, Table 4.24 presents the Woods Gordon survey results for reported sales of Ontario EPI solid and hazardous waste disposal and treatment goods and services for 1987.

As noted above, all the Woods Gordon data exclude services provided by governments directly, and for the solid waste field these may represent a substantial fraction of the activity in the sector.

The total 1987 revenues of the EPI are also estimated, as summarized in Table 4.25.

**Table 4.23**
**SUMMARY OF INFORMATION FROM WASTE AGE MANUFACTURERS GUIDES**

| Guide/Item | Reference | No. of Ontario Manufacturers | No. of Canadian Manuf. | Total No. of Manufacturers |
|---|---|---|---|---|
| *I. Recycling Containers* | 7 | | | |
| curbside | | 5 | 6 | 40 |
| depot | | 0 | 0 | 17 |
| *II. Refuse Containers* | 2 | | | |
| containers | | 0 | 1 | 32 |
| barrels | | 0 | 0 | 15 |
| costers | | 0 | 0 | 8 |
| covers/lids | | 0 | 0 | 19 |
| decals | | 0 | 0 | 6 |
| delivery carriers | | 0 | 0 | 6 |
| liners | | 0 | 0 | 3 |
| *III. Waste Processing Equipment* | 5 | | | |
| can densifiers | | 0 | 0 | 12 |
| conveyors | | 0 | 0 | 31 |
| glass crushers | | 0 | 0 | 13 |
| screens & trommels | | 0 | 0 | 7 |
| magnetic separators | | 1 | 1 | 10 |
| shredders | | 2 | 2 | 43 |
| storage & retrieval bins | | 0 | 0 | 4 |
| wood waste grinders | | 0 | 0 | 7 |
| *IV. Baling Equipment* | 3 | | | |
| horizontal balers | | 0 | 0 | 17 |
| vertical balers | | 0 | 0 | 16 |
| baling wire suppliers | | 0 | 0 | 20 |
| bale typing equipment | | 0 | 0 | 8 |
| *V. Stationary Compactors* | 1 | 2 | 5 | 50 |
| *VI. Transfer Trailer* | 6 | | | |
| trailers | | 2 | 4 | 36 |
| tarps | | 0 | 0 | 10 |
| yard jockeys | | 0 | 0 | 7 |
| *VII. Landfill Equipment* | 4 | 1 | 1 | 16 |

**Table 4.23**
**SUMMARY OF INFORMATION FROM WASTE AGE MANUFACTURERS GUIDES**

| Guide/Item | Reference | No. of Ontario Manufacturers | No. of Canadian Manuf. | Total No. of Manufacturers |
|---|---|---|---|---|

**References:**


1. Waste Age, July 1990. 1990 Stationary Compactor Byers Guide, pg. 121.
2. Waste Age, July 1990. 1990 Refuse Containers and Accessory Guide, pg. 131.
3. Waste Age, August 1990. 1990 Baling Equipment Guide, pg. 161.
4. Waste Age, August 1990. 1990 Landfill Equipment Guide, pg. 161.
5. Waste Age, September 1990. 1990 Waste Processing Equipment Guide pg. 161.
6. Waste Age, September 1990. 1990 Transfer Trailer and Accessory Guide, pg. 171.
7. Waste Age, October 1990. 1990 Recycling Containers Guide, pg. 155.

### 4.6.4 Future Trends

Woods Gordon also commented on a number of future trends. As government requirements become more stringent, survey respondents anticipate annual growth rates of greater than 15%. Free trade with the United States is expected to be modestly beneficial to manufacturers and consultants who are in a position to export. However, high technology items and general industrial goods are largely imported.

Survey respondents in the Woods Gordon study made comments related to the effects of government policy on industry prospects. In general, purchasers of EP goods and services believe they will be able to meet more stringent environmental protection regulations as long as they don't exceed American requirements.

On the other hand, suppliers in the EPI feel that if government policy played a leading role, rather than following the U.S., development of innovative EP goods and services would be stimulated, and future export opportunities maximized. Suppliers favour increased government support for R&D and greater flexibility in approvals for pilot projects.

**Table 4.24**
**REPORTED SALES OF WASTE DISPOSAL AND TREATMENT GOODS AND SERVICES, ONTARIO, 1987**

| Product/Service | Number of Firms | 1987 Sales |
|---|---|---|
| Equipment/ Instruments/Supplies | 21 | $30,376,980 |
| Solid/Hazardous Waste Disposal and Destruction Services | 16 | $129,506,791 |
| Recycling Services | 12 | $145,799,246 |
| Consulting, Other Services | 34 | $20,271,820 |
| Total | 83 | $325,954,837 |

| Table 4.25<br>ESTIMATED 1987 REVENUES OF THE ONTARIO ENVIRONMENTAL PROTECTION SECTOR | |
|---|---|
| **Commodity** | **Estimated 1987 Revenues** |
| Machinery, Equipment, Instruments, Supplies | $250 - $400 million |
| Recycling Services | $500 - $1,000 million |
| Waste Disposal and Destruction Services | $300 - $400 million |
| Construction Services | $350 - $500 million |
| Consulting Engineering and Analytical Services | $100 - $200 million |
| **Total** | **$1.5 - $2.5 billion** |

# Section 5
# PHYSICAL AND ECONOMIC DIMENSIONS OF WASTE RECYCLING

## 5.1 GENERAL

The recycling of waste materials is a component of the waste management system whose importance and impact has increased dramatically in the last few years. This has been prompted to a great extent by a projected shortfall in landfill capacity as well as increased awareness on the part of the public, municipalities and the ICI sector, that many waste materials are resources which can be put to useful purpose, and landfilling them does not realize their full potential. Also, tipping fees have increased to a point where recycling is more economically viable than it was a number of years ago. Figure 5.1 shows how the various components of the recycling system interact. This Section describes the present physical and economic dimensions of recycling in Ontario under three main headings, namely:

- Recycling Programs
- Material Recovery Facilities (MRFs)
- Private and Third Sector Recycling Agents (Recyclers)

## 5.2 RECYCLING PROGRAMS

### 5.2.1 The History of Recycling in Ontario

Ontario's Blue Box recycling program, recognized world wide for its ingenuity, has evolved from a drop-off depot strategy to a comprehensive curbside collection program. The program's momentum has carried it beyond the curbside program to include multi-unit buildings, rural areas and schools.

Prior to 1980, recycling was characterized as a short-term, often single material business venture that responded to the demands of the end-user market. The appearance of depots and buy-back centres fluctuated with the demand and price for a secondary material. Programs were generally operated by either small entrepreneurs who capitalized on the short-term financial potential of the recycling industry or non-profit organizations, who became involved in recycling for fundraising purposes. Due to the sporadic nature of the business, securing a reliable, stable recycling industry became a difficult task.

A number of events helped shape the future of the Blue-Box recycling program. In the early 1980s The Ministry of the Environment published the report, A Blueprint for Waste Management in Ontario, which communicated its commitment to pursuing the 4R (reduce, reuse, recycle, recover) hierarchy approach to waste management.

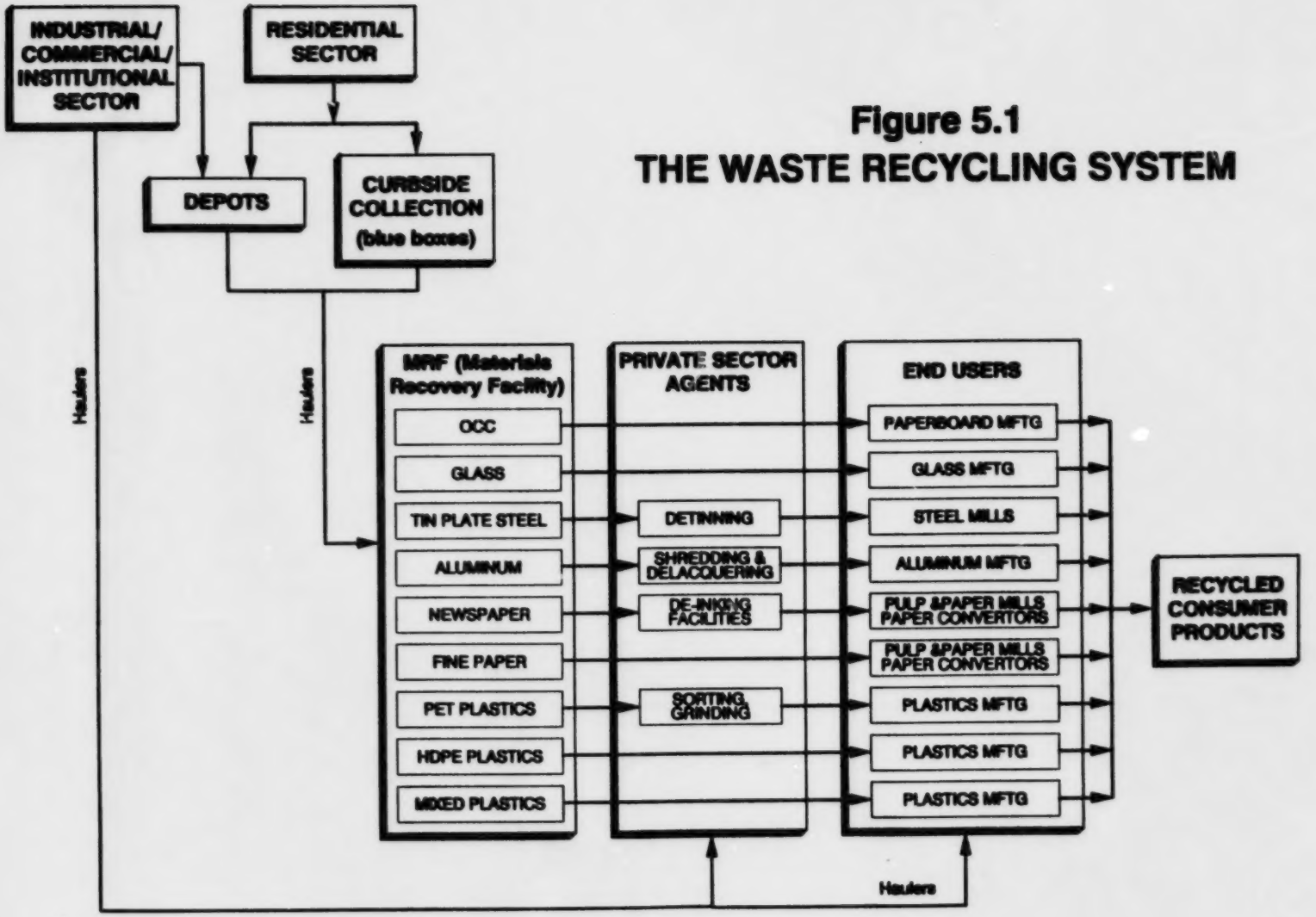



**Figure 5.1**
**THE WASTE RECYCLING SYSTEM**

Concurrent to the publication of the report, the City of Kitchener, aided by Laidlaw Waste Systems Inc., launched its successful curbside recycling program. Initiated as a pilot feasibility project, enough public support and pressure was exerted on the City Council of Kitchener that a full-scale program was introduced in 1983. For the first time, the program operator secured a commitment from Quebec and Ontario Paper Company to accept all of its old newspapers over a continuous period of time. With this commitment the foundations for a stable recycling infrastructure had been laid.

The recycling market was further strengthened with the introduction of the amended Soft Drink Container Legislation by the Ministry of the Environment in 1985. This piece of legislation aimed to encourage full-scale recycling of soft drink containers in Ontario by balancing the sales of nonrefillable containers with the sales of refillable containers. As recycling rates for nonrefillable soft drink containers reached the 50% mark, then the number of refillable containers designated for sales would be reduced. The most effective means of achieving the 50% recycling rate was determined by the advisory group, the Recycling Advisory Committee (RAC). RAC determined that a minimum 50% recycling rate could be met by providing 50% of Ontario's single-family households with a Blue-Box container and the opportunity to participate in the curbside collection recycling program.

Following closely on the heels of RAC's formation, the soft drink industry and related associations established Ontario Multi-Material Recycling Incorporated (OMMRI) in 1987 to oversee the implementation of the Blue Box program in Ontario. Funding programs, based on a cost-share approach, enticed municipalities to initiate curbside programs. Essentially, one-third of the capital costs incurred by the municipality were paid for by OMMRI and the remaining two-thirds of the costs were split between the Ministry of the Environment and the municipality.

The curbside program was quickly adopted by municipalities throughout Ontario. First launched in January 1987 by OMMRI and the MOE, the Blue Box program served over 400,000 single family households in the first year alone. By the end of 1989, approximately 1.8 million single family households were estimated to be participating in the Blue Box program, well exceeding the 50% recycling rate established by the Recycling Advisory Committee. When the program has been fully implemented, serving over 2.1 million households, the curbside recycling program will have penetrated 80% and 70% of Ontario's urban and rural single-family households respectively. Further explanation of the Blue Box system is provided in Section 3.4.1 - Residential Waste Recycled.

### 5.2.2 Physical Dimensions

Since 1981, with the introduction of a multi-material curbside pilot program in the City of Kitchener, the Blue Box program has grown at a phenomenal rate. Since the first

full-scale Blue Box program was launched in the City of Kitchener in 1983, the program's availability increased in 1987 to 41 communities (34 full-scale and 7 pilot programs). In 1989, 138 communities offered the services of a full-scale curbside recycling program. Table 5.1 shows the number of Blue Boxes distributed throughout Ontario. According to OMMRI data (1990), Ontario's multi-material recycling program has grown from 34% penetration of households in December 1988 to 60% penetration of household units (including apartment and rural areas) in June 1990, as shown in Figure 5.2.

Section 3.4.1 of this report - Residential Waste Recycled - provides a detailed description of the secondary data sources used and methodology applied to establish the quantities of material recycled in Ontario in 1987 and 1989. As illustrated in Table 5.2, the amount of traditional recycled materials (newspaper, glass, steel, aluminum, PET) collected in the residential sector has increased between 1987 and 1989. It is estimated that Ontario municipalities recovered 206,402 tonnes of recyclable materials in 1989 compared with 97,047 tonnes in 1987. The per Blue Box generation rate shown in this Table for 1987 and 1989 requires clarification. In 1987, while many municipalities were participating in residential recycling programs, the majority of the programs offered depot collection or curbside collection programs not classified as Class 1 (Blue Box) recycling programs. There were not very many Blue Boxes in circulation (399,000) hence per Blue Box generation rates appear artificially high, if all materials recycled are included. Consequently, calculating the amount of material recovered per Blue Box is exaggerated when depot materials are included in the calculation. The number of kg of material recovered per Blue Box in 1987 is similar to the figure calculated for 1989 if extraneous data are removed. It must be kept in mind that for each municipality the amount of materials collected through depot collection programs are combined with the Blue Box program results in the database. Table 5.3 presents the classes of recycling programs operating in Ontario in 1987.

### 5.2.3 Economic Dimensions

Since 1987, the Ministry of the Environment in conjunction with OMMRI have encouraged municipalities to implement residential curbside separation programs using a cost-sharing approach. In February 1990, the MOE and OMMRI II delegated $38.7 million and $45 million respectively over a five year period (refer to Table 5.4) with the aim to eventually offer curbside recycling to 80% and 70% of Ontario's urban and rural single-family households respectively, and to 20% of Ontario's apartments.

The most effective of these programs has been the MOE's Municipal Recycling Support Program (MRSP) and OMMRI's complementary funding initiative. Whereas the MRSP was developed to assist municipalities with the design, implementation and operation of recycling programs, OMMRI provides grants on a more limited basis.

Appendix C describes the various funding programs available for support of both residential and ICI waste recycling in Ontario at this time.

**Table 5.1**
**ONTARIO SINGLE FAMILY DWELLINGS SERVED**
**BY THE BLUE BOX PROGRAM 1981-1989**

| County | Number of Blue Boxes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
| Brant | | | | | | | | | 29150 |
| Bruce | | | | | | | | | 3350 |
| Kenora | | | | | | | | 3000 | 3000 |
| Dufferin | | | | | | | | | 8400 |
| Durham | | | | | | | 13000 | 85400 | 90000 |
| Essex-Windsor | | | | | | | 16500 | 83450 | 102600 |
| Frontenac | | | | | | | | | 25700 |
| Grey | | | | | | | | 6400 | 15500 |
| Halton | | | 900 | 900 | 900 | 900 | 5900 | 62800 | 70100 |
| Hamilton-Wentworth | | | | | | | 14500 | 107660 | 109860 |
| Huron | | | | | | | | | 1900 |
| Lambton | | | | | | | | | 11100 |
| Leeds-Grenville | | | | | | | | 6400 | 6400 |
| Lennox and Addington | | | | | | | | | 3700 |
| Metro Toronto | | 3300 | 3300 | 3300 | 3300 | 3300 | 3300 | 199300 | 447300 |
| Middlesex | | | | | | | | | 6100 |
| Muskoka/Haliburton | | | | | | | 1200 | 10800 | 25340 |
| Niagara | | | | | 11500 | 30500 | 36000 | 115500 | 126100 |
| Northumberland | | | | | | | 7400 | 11600 | 12100 |
| Ottawa-Carleton | | | | | | | 101500 | 139700 | 154900 |
| Oxford | | | | | | | 2700 | 2750 | 10750 |
| Peel | | | | | | 84500 | 99300 | 144800 | 153900 |
| Perth | | | | | | | 7500 | 7500 | 13450 |
| Peterborough | | | | | | | 18000 | 21500 | 21500 |
| Renfrew | | | | | | | | | 1300 |
| Simcoe | | | | | | | 7000 | 86200 | 86350 |
| Stormont-Glengarry | | | | | | | | | 700 |
| Victoria | | | | | | | | | 5150 |
| Waterloo | 300 | 300 | 35300 | 35300 | 35300 | 35300 | 37400 | 54700 | 79400 |
| Wellington | | | | | | | 27900 | 35350 | 37000 |
| York | | | | | | | | 66950 | 129900 |
| Total | 300 | 3600 | 39500 | 39500 | 51000 | 154500 | 399100 | 1251760 | 1792000 |

Source: OMMRI

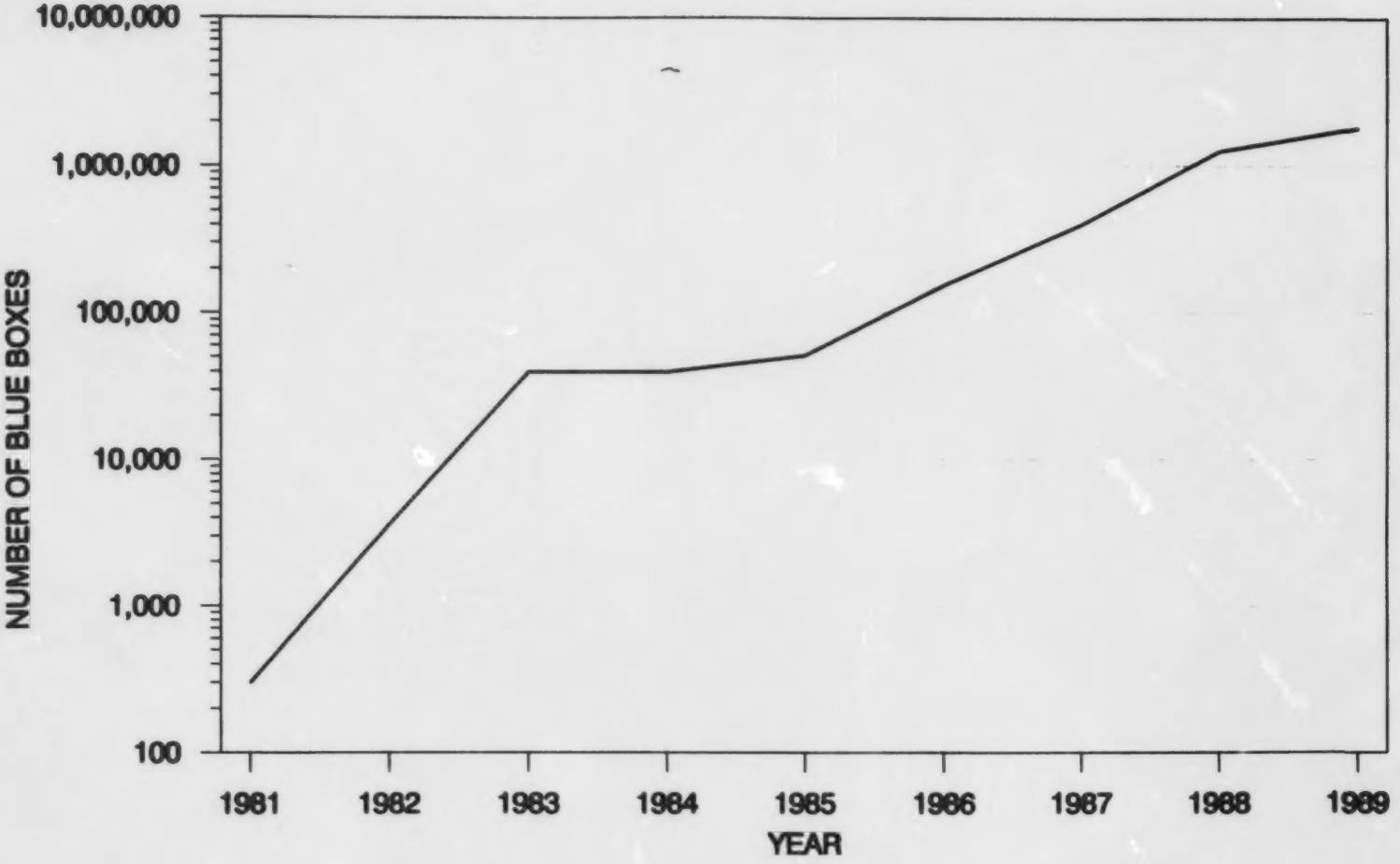



**Figure 5.2**

**SINGLE FAMILY DWELLINGS SERVED BY BLUE BOX**

## Table 5.2
## MATERIALS RECOVERED IN THE RESIDENTIAL SECTOR IN ONTARIO IN 1987 AND 1989

| | Newspaper | Glass | Steel | Aluminum | PET | Total |
|---|---|---|---|---|---|---|
| 1987 (tonnes) | 81913 | 11027 | 4071 | ---<br>Class 1 only | 36 | 97047<br>56051 |
| Kg/Blue Box | 205.2 | 27.6 | 10.2 | ---<br>Class 1 only | 0.09 | 243.2*<br>140.4** |
| 1989 (tonnes) | 155904 | 31360 | 17024 | 1613 | 502 | 206402 |
| Kg/Blue Box | 87 | 18 | 9.5 | 0.9 | 0.29 | 115.2*** |

* Total quantity generated in 1987 divided by 399,100 Blue Boxes

** Quantity generated by Class 1 programs in 1987 divided by 399,100 blue boxes.

*** Quantity generated by Class 1 programs in 1989 divided by 1,792,000 blue boxes.

Source: OMMRI and RIS

**Table 5.3**
**THE STATUS OF RESIDENTIAL RECYCLING IN ONTARIO**
**1987 and 1989**

| County | Municipality | 1987 | | | | | 1989 |
|---|---|---|---|---|---|---|---|
| | | Class 1 | Class 2 | Class 3 | Class 4 | Class 5 | Class 1 |
| Metro | Toronto | X | | | X | | X |
| | Etobicoke | | | X | | X | X |
| | Scarborough | | | X | X | | X |
| | North York | | | X | X | | X |
| | York | | | X | X | | X |
| | East York | | | | | | X |
| Durham | Oshawa | | | X | X | | X |
| | Ajax | X | | | | | X |
| | Newcastle | | | X | X | | X |
| | Pickering | | | X | X | | X |
| | Whitby | | | | X | | X |
| | Brock | | | | | | X |
| | Scugog | | | | | | X |
| | Uxbridge | | | | | | X |
| Halton | Burlington | X | | | X | | X |
| | Halton Hills | | X | | | X | X |
| | Milton | X | | | X | | X |
| | Oakville | | X | | X | | X |
| Hamilton/ | Hamilton | | | X | X | | X |
| Wentworth | Stoney Creek | X | | | | | X |
| | Ancaster | X | | | | | X |
| | Dundas | | X | | | | X |
| | Flamborough | | | | | | X |
| | Glanbrook | | | | | | X |
| Niagara | Niagara Falls | X | | | | | X |
| | Port Colborne | | | X | | | X |
| | St Catharines | X | | | | | X |
| | Welland | | X | | | | X |
| | Thorold | | X | | X | | X |
| | Fort Erie | | X | | X | | X |
| | Grimsby | X | | | X | | X |
| | Lincoln | X | | | X | | X |
| | Niagara on the Lake | | | | | | X |
| | Pelham | X | | | X | | X |
| | Wainfleet | | | | | | X |
| | West Lincoln | X | | | X | | X |

## Table 5.3
## THE STATUS OF RESIDENTIAL RECYCLING IN ONTARIO
## 1987 and 1989 (Cont'd)

| County | Municipality | 1987 | | | | | 1989 |
|---|---|---|---|---|---|---|---|
| | | Class 1 | Class 2 | Class 3 | Class 4 | Class 5 | Class 1 |
| Ottawa | Ottawa | X | | | X | | X |
| | Kanata | | X | | | | X |
| | Nepean | X | | | | | X |
| | Gloucester | X | | | | | X |
| | Cumberland | | | | | | X |
| | Osgoode | | | | | | X |
| Peel | Brampton | X | | | | | X |
| | Mississauga | X | | | X | | X |
| | Caledon | X | | | | X | X |
| Waterloo | Cambridge | X | | | | | X |
| | Kitchener | X | | | | | X |
| | Waterloo | | | | | | X |
| | Wilmot | | | | X | | X |
| York | Markham | | | | X | | X |
| | Newmarket | | | X | | X | X |
| | Richmond Hill | | X | | X | | X |
| | Vaughan | | | | X | | X |
| | Whitchurch-Stoffville | | | | X | | X |
| | East Gwillimbury | | | | | | X |
| | Georgina | | | | | | X |
| | King | | | | | | X |
| Muskoka | Bracebridge | X | | | X | | X |
| | Gravenhurst | | | | | | X |
| | Huntsville | | | | | | X |
| | Georgian Bay | | | | | | X |
| | Muskoka Lakes | | | X | | X | X |
| Brant | Brantford | | X | | X | | X |
| | Paris | | | | | | X |
| | South Dumfries | | | | | | X |
| Bruce | Bruce Twp | | | | | | X |
| | Mildmay | | | | | | X |
| | Elderslie Twp | | | | | | X |
| Dufferin | Orangeville | | | | | | X |
| | Shelburne | | | | | | X |
| | Mono Twp | | | | | | X |

**Table 5.3**
**THE STATUS OF RESIDENTIAL RECYCLING IN ONTARIO**
**1987 and 1989 (Cont'd)**

| County | Municipality | 1987 | | | | | 1989 |
|---|---|---|---|---|---|---|---|
| | | Class 1 | Class 2 | Class 3 | Class 4 | Class 5 | Class 1 |
| Essex | Windsor | | | X | X | | X |
| | Amherstberg | X | | | | | X |
| | Essex | X | | | | | X |
| | Leamington | X | | | | | X |
| | Tecumseh | X | | | X | | X |
| | Sandwich West | X | | | | | X |
| Frontenac | Kingston | | | | | X | X |
| | Kingston Twp | | | | | | X |
| | Pittsburg | | | | | | X |
| Grey | Owen Sound | | | X | | | X |
| | Durham | | | | | | X |
| | Hanover | | | | | | X |
| | Neustadt | | | | | | X |
| | Egremont Twp | | | | | | X |
| Huron | Howick | | | | | | X |
| | Wingham | | | | | | X |
| | Grey Twp | | | | | | X |
| Kent | Ridgetown | | | X | | X | X |
| Lambton | Sarnia | | | X | | X | X |
| | Forest | | | | | | X |
| Leeds & Gren | Brockville | | | | | | X |
| Lennox & Add | Ernestown | | | | | | X |
| Middlesex | London | | | X | | | X |
| | London Twp | | | | | | X |
| | Lobo | | | | | | X |
| | West Nissouri | | | | | | X |
| | North Dorchester | | | | | | X |
| Northumberland | Cambellford | | | | | | X |
| | Cobourg | X | | | X | | X |
| | Port Hope | X | | | | | X |
| | Brighton | | | | | | X |
| | Colbourne | | | | | | X |
| | Haldimand | | | | X | | X |
| | Hamilton Twp | X | | | X | | X |
| | Hope Twp | | | | X | | X |
| Oxford | Woodstack | | X | | | | X |
| | Ingersoll | | | | | | X |
| | E Zorra-Tavistock | | | | | | X |
| | S W Oxford | X | | | | | X |
| | Zorra | | | | | | X |

**Table 5.3**
**THE STATUS OF RESIDENTIAL RECYCLING IN ONTARIO**
**1987 and 1989 (Cont'd)**

| County | Municipality | 1987 | | | | | 1989 |
|---|---|---|---|---|---|---|---|
| | | Class 1 | Class 2 | Class 3 | Class 4 | Class 5 | Class 1 |
| Perth | Stratford | X | | | X | | X |
| | St Marys | | | | | | X |
| | Mitchell | | | | | | X |
| | Milverton | | X | | X | | X |
| | North Easthope | | | | | | X |
| | South Easthope | | | | | | X |
| | Downie | | | | | | X |
| | Hibbert | | | | | | X |
| Peterborough | Peterborough | | X | | X | | X |
| Renfrew | McNab | | | | | | X |
| Simcoe | Barrie | | X | | X | | X |
| | Alliston | | | | | | X |
| | Collingwood | | | | | | X |
| | Midland | X | | | | | X |
| | Penetanguishene | X | | | | | X |
| | Stayner | | | | X | | X |
| | Wasaga | | | | | | X |
| | Adjala | | | | X | | X |
| | Creemore | | | | | | X |
| | Tottnham | | | | X | | X |
| | Innisfil | | | | | | X |
| | Orillia | | | | | | X |
| | Essa | | | | | | X |
| | Nottawasaga | | | | | | X |
| | Oro | | | | | | X |
| | Tay | X | | | | | X |
| | Tiny | X | | | | | X |
| | Elmvale | | | | | | X |
| | Victoria | X | | | | | X |
| | Port McNicholl | X | | | | | X |
| Stormont-Glen | Winchester | | | | | | X |
| Victoria | Lindsay | | | | | | X |
| | Fenelon Falls | | | | | X | X |

**Table 5.3**
**THE STATUS OF RESIDENTIAL RECYCLING IN ONTARIO**
**1987 and 1989 (Cont'd)**

| County | Municipality | 1987 | | | | | 1989 |
|---|---|---|---|---|---|---|---|
| | | Class 1 | Class 2 | Class 3 | Class 4 | Class 5 | Class 1 |
| Wellington | Guelph | X | | | X | | X |
| | Fergus | X | | | | | X |
| | Mount Forest | | | | | X | X |
| | Elora | X | | | | | X |
| | Erin | X | | | X | | X |
| | Eramosa | | | | | | X |
| | Erin Twp | X | | | | | X |
| | Maryborough | | | | | | X |
| | Nichol | X | | | | | X |
| | Peel Twp | | | | X | | X |
| | Puslinch | | | | X | | X |
| | West Garafraxa | | | | X | | X |
| Kenora | Dryden | | | | | | X |

Source: OMMRI

Note: Refer to Section 3.4.1 for a description of Classes.

| Table 5.4<br>FUNDING AVAILABLE FOR RECYCLING PROGRAMS IN 1990 | |
|---|---|
| **Ministry of the Environment - Annual Funding** | |
| $25.1 million | • Municipal curbside programs.<br>• Apartment and depot programs. |
| $8.2 million | • Industrial waste reduction, reuse and recycling programs. |
| $4.0 million | • Community and home-based composting projects. |
| $2.0 million | • Research and development of end-use and markets. |
| **Ontario Multi-Material Recycling Incorporated (OMMRI)** | |
| $45.0 million | • To support various recycling activities over a five year period. |
| Source: Hanson, May 1990. | |

**Data Availability**

To better understand the costs associated with municipal recycling programs, investigations were conducted to identify secondary sources of economic data. Extensive research led to the discovery of two reliable sources of information about the capital and operating expenditures associated with municipal recycling programs. These were:

- Ministry of the Environment, Municipal Recycling Support Program

  Since the Municipal Recycling Support Program's commencement, the Ministry of the Environment has required program operators to submit grant applications for Ministry review and approval. Financial information consists of capital and operating expenditures associated with the implementation of the curbside recycling program. A description of the MRSP is contained in Appendix C.

- Ministry of Treasury and Economics, Public Accounts of Ontario

  A further source of information on financial expenditures associated with recycling programs is the COBIS report. The government of Ontario publishes annual reports detailing the monies spent by each ministry for the year-end fiscal period. Although the expenditure information is disaggregated according to the program recipient, the level of detail fell short of this project's requirements.

Data from the MRSP were used to estimate the financial component of recycling for inclusion into the study database. The MRSP data provided to the study team provides grant approval information over a three year period (1987, 1988 and 1989). Although the total financial expenditures associated with recycling exceed those costs reported in the MRSP grant applications, municipalities fund the majority of the recycling costs through capital and operating budgets.

Through conversations with supervisors of the MRSP program, it also became apparent that not all municipalities submitted grant applications for payment even though they may have introduced a curbside recycling program. Despite this limitation, in most cases, those municipalities reported by OMMRI to have a curbside separation program also applied for funding through the MRSP grant program.

**Data Manipulation**

Due to the different cost-sharing structure of the capital and operating grants of various funding programs in effect in Ontario described in Appendix C, the actual costs incurred were estimated by two methods, using available data. These are described below:

- **Operating Costs** - The MOE funds the operating costs using a declining cost-sharing schedule. The first year of the grant applications the recycling program operator receives 50% funding and for each subsequent year the funding decreases by 10%, from 40% to 30% to 20% to 10% in the final year of the five year program. This funding schedule was applied for each program operating in Ontario beginning with the year 1987. If the program commenced after 1987 (in 1988 or 1989) then the first year of the funding schedule would begin in that year.

- **Capital Costs** - The MOE funds one-third of the capital costs for each year the grant is approved. This simple funding schedule was applied for every program regardless of the year involved.

In some instances the curbside recycling program is contracted to a private company or a non-profit organization. The grants approved for these programs usually represent the costs incurred by the company to service a group of municipalities. To accommodate the aggregated nature of the private/nonprofit sector operated programs, a separate coded number was issued to each program in the study database. However, the same data manipulation principals were applied to the capital and operating costs reported in the MRSP.

**Results**

It appears from the available data that the amount of monies expended by municipalities on recycling programs increased between 1987 and 1989. In 1987 it was estimated that approximately $10 million was spent on a variety of recycling programs ranging from depot to curbside recycling. By 1988, the estimated expenditures increased to $30 million as more municipalities implemented the Blue Box recycling program. It is estimated that the expenditures in 1989 equalled approximately $42.5 million. Table 5.5 summarizes the operating and capital expenditures for Ontario's municipalities to implement and maintain municipal recycling programs.

In addition, financial statements for the other funding programs were provided where available. Included in the 1989 provincial total is the funding from the Municipal Reduction/Reuse Program, as recorded in the 1988-1989 COBIS (Public Expenditure) Report (see Table 5.6).

Comparing the costs to collect one tonne of recycled materials in 1987 and 1989 shows that the overall costs appear to have risen. Based on an estimated total cost of $9,975,768 (capital and operating) to collect an estimated 97,000 tonnes of material in 1987, municipalities incurred an average expense of $102.79 per tonne to collect and process materials for recycling. **A breakdown of the proportion of 1987 capital to operating costs was not available.** Based on an estimated operating cost of $25,764,792 in 1989 and an estimated 206,403 tonnes of material collected, the operating cost for collection and processing recycled materials from residential sources averaged $124.83/tonne. This excludes the estimated $16,803,380 expended on capital equipment. The increased operating cost per tonne is likely related to the fact that more materials are now being handled by recycling programs, causing an increase in required sorting time.

These numbers represent gross costs and do not take into account the monies received through the sale of the materials to the recycling markets. Table 5.7 presents the prices paid by the recycling markets for newspaper, glass, steel and PET in 1988, 1989 and 1990. The table illustrates that the prices paid have declined over the past several years, and while the price received for glass has remained constant, municipalities have met with more stringent sorting specifications resulting in higher capital/retrofit equipment costs.

## Table 5.5
## ESTIMATED EXPENDITURE ON RECYCLING PROGRAMS IN ONTARIO 1987 TO 1989

| County | Municipality | 1987 | 1988 | | 1989 | |
|---|---|---|---|---|---|---|
| | | Cost ($) | Operating ($) | Capital ($) | Operating ($) | Capital ($) |
| Metro | | 366,500 | 70,438 | 0 | 0 | 0 |
| | Toronto | NAP | 161,600 | 884,400 | 0 | 0 |
| | Etobicoke | NAP | 344,000 | 0 | 1,408,250 | 124,017 |
| | Scarborough | NAP | 0 | 0 | 1,040,850 | 3,405,666 |
| | North York | 19,500 | 519,375 | 1,679,700 | 0 | 0 |
| | York | NAP | 198,400 | 0 | NAP | NAP |
| | East York | NAP | 48,080 | 553,542 | 60,100 | 553,542 |
| Durham | | 766,000 | 1,203,500 | 238,590 | 2,145,132 | 1,148,400 |
| Halton | | 936,000 | 10,400 | 0 | 149,622 | 1,584 |
| Hamilton/ | Hamilton | 325,350 | 0 | 0 | 0 | 0 |
| Wentworth | Stoney Creek | NAP | 11,600 | 17,160 | 0 | 0 |
| | Ancaster | 5,500 | NAP | NAP | 0 | 12,157 |
| | Dundas | NAP | 2,300 | 38,280 | 0 | 2,838 |
| | Flamborough | 23,866 | 0 | 4,620 | 0 | 0 |
| | Glanbrook | NAP | 9,960 | 43,989 | 0 | 0 |
| Niagara | Niagara Falls | NAP | 0 | 17,526 | 0 | 0 |
| | Port Colborne | NAP | 38,440 | 151,322 | 0 | 0 |
| | St Catharines | 333,000 | 0 | 104,511 | 475,938 | 30,525 |
| | Welland | 55,200 | 0 | 14,995 | 0 | 0 |
| | Thorold | 23,500 | 0 | 16,190 | 0 | 0 |
| | Fort Erie | NAP | 66,200 | 226,380 | 0 | 0 |
| | Grimsby | NAP | 0 | 3,350 | 0 | 2,640 |
| | Lincoln | NAP | 0 | 3,350 | 0 | 0 |
| | Niagara on the La | 19,100 | 0 | 6,353 | 0 | 0 |
| | Pelham | NAP | 0 | 3,350 | 0 | 0 |
| | Wainfleet | NAP | NAP | NAP | 29,280 | 22,011 |
| | West Lincoln | NAP | 0 | 2,679 | 0 | 0 |
| Ottawa | Ottawa | 820,000 | 1,926,225 | 0 | 2,665,773 | 0 |
| | Kanata | NAP | 0 | 11,022 | 87,560 | 145,316 |
| | Cumberland | NAP | 110,160 | 276,887 | 152,800 | 0 |
| Peel | Brampton | 628,000 | 920,475 | 146,520 | 517,044 | 6,369 |
| | Mississauga | 1,109,500 | 1,241,935 | 0 | 1,704,863 | 109,725 |
| | Caledon | 30,800 | 116,625 | 169,884 | 109,032 | 164,439 |
| Waterloo | | NAP | 0 | 0 | 295,620 | 4,298,613 |
| | Cambridge | 27,200 | 485,058 | 0 | 587,400 | 16,500 |
| | Waterloo | 146,332 | 175,875 | 0 | 317,823 | 132,957 |
| | Wilmot | NAP | 0 | 0 | 8,000 | 0 |

**Table 5.5**
**ESTIMATED EXPENDITURE ON RECYCLING PROGRAMS IN ONTARIO 1987 TO 1989 (Cont'd)**

| County | Municipality | 1987 | 1988 | | 1989 | |
|---|---|---|---|---|---|---|
| | | Cost ($) | Operating ($) | Capital ($) | Operating ($) | Capital ($) |
| York | | NAP | 50,000 | 0 | 562,375 | 320,760 |
| | Markham | NAP | 361,400 | 1,056,000 | 919,500 | 6,600 |
| | Newmarket | NAP | 0 | 0 | 200,340 | 416,625 |
| | Richmond Hill | 376,600 | 0 | 329,109 | 440,720 | 167,442 |
| | Vaughan | NAP | 19,000 | 0 | 0 | 0 |
| | Whitchurch-Stouff | NAP | 45,420 | 140,168 | 0 | 0 |
| | East Gwillimbury | NAP | 43,240 | 131,241 | 0 | 0 |
| | Georgina | NAP | 10,000 | 0 | 235,125 | 357,291 |
| Muskoka | Bracebridge | 67,100 | 28,875 | 0 | 0 | 0 |
| Brant | Paris | NAP | NAP | NAP | 60,620 | 27,984 |
| Bruce | Bruce Twp | NAP | 0 | 0 | 35,620 | 16,038 |
| | Mildmay | NAP | 0 | 0 | 15,340 | 13,101 |
| | Elderslie | NAP | 0 | 0 | 9,346 | 3,373 |
| Dufferin | Orangeville | NAP | 15,000 | 0 | 163,450 | 36,795 |
| Essex | | 991,240 | 1,397,946 | 2,214,663 | 2,472,250 | 523,512 |
| Frontenac | Kingston | NAP | 0 | 2,034,450 | 364,000 | 226,050 |
| Grey | Owen soumd | NAP | 36,020 | 141,471 | 107,300 | 171,435 |
| | Hanover | NAP | NAP | NAP | 18,020 | 21,186 |
| | Neustadt | NAP | 3,230 | 1,584 | 6,238 | 33 |
| | Egremont | | | | | |
| Huron | Howick | NAP | 0 | 0 | 25,140 | 22,275 |
| | Wingham | NAP | 6,120 | 9,620 | 30,663 | 0 |
| | Grey Twp | NAP | 17,300 | 9,801 | 0 | 0 |
| Lambton | Sarnia | NAP | 10,000 | 0 | 0 | 0 |
| | Forest | | | | | |
| Leeds-Gren | Brockville | NAP | 71,120 | 576,609 | 25,828 | 165,264 |
| Middlesex | London | NAP | 0 | 0 | 535,000 | 0 |
| | N Dorchester | NAP | NAP | NAP | 70,380 | 164,109 |
| Oxford | Woodstock | 6,000 | 0 | 0 | 0 | 0 |
| | E Zorra-Tavistock | NAP | 17,860 | 15,576 | 85,875 | 0 |
| | S W Oxford | 56,000 | 51,325 | 29,700 | 67,947 | 14,289 |
| | Zorra | NAP | 13,040 | 21,450 | 81,000 | 0 |
| Perth | Stratford | 156,860 | 100,025 | 115,104 | 89,496 | 89,364 |
| | St Mary's | NAP | 0 | 0 | 33,980 | 12,870 |
| | Mitchell | NAP | NAP | NAP | 16,100 | 9,240 |
| | N Easthope | NAP | MA[ | NAP | 13,835 | 4,818 |
| | S Easthope | NAP | NAP | NAP | 13,835 | 4,818 |
| | Downie | NAP | NAP | NAP | 34,080 | 7,392 |
| | Hibbert | NAP | 0 | 0 | 7,020 | 9,983 |
| Peterborough | Peterborough | NAP | NAP | 1,744,809 | 0 | 0 |
| Renfrew | McNab | NAP | 0 | 0 | 19,960 | 44,979 |

**Table 5.5**
**ESTIMATED EXPENDITURE ON RECYCLING PROGRAMS IN ONTARIO**
**1987 TO 1989 (Cont'd)**

| County | Municipality | 1987 | 1988 | | 1989 | |
|---|---|---|---|---|---|---|
| | | Cost ($) | Operating ($) | Capital ($) | Operating ($) | Capital ($) |
| Simcoe | Barrie | 59,800 | NAP | NAP | 0 | 0 |
| | Innisfil | NAP | 70,400 | 69,630 | 138,750 | 5,280 |
| | Orillia | 10,000 | 18,700 | 152,262 | 133,225 | 0 |
| | Oro | NAP | 0 | 0 | 48,800 | 50,160 |
| | Elmvale | | 9,060 | 4,620 | 10,825 | 7,557 |
| Stormont-Glen | Winchester | 4,300 | 550 | 6,435 | 0 | 0 |
| Victoria | Lindsay | NAP | 0 | 126,489 | 104,560 | 473,220 |
| Wellington | Guelph | 492,250 | 657,000 | 122,100 | 992,970 | 27,258 |
| Kenora | Dryden | NAP | 0 | 0 | 1,500 | 672,098 |
| Lambton (Bluewater Recycling Association) | Forest<br>Alvinston<br>Arkona<br>Grand Bend<br>Thedford<br>Watford<br>Bosanquet Twp | NAP | NAP | NAP | 226,800 | 459,360 |
| Haldimand-Nor | | 26,000 | 32,765 | 0 | 0 | 733,920 |
| Muskoka (Muskoka Recycling Association) | Bracebridge<br>Gravenhurst<br>Huntsville<br>Muskoka Lakes | NAP | 126,000 | 518,100 | 421,950 | 43,098 |
| Niagara (Niagara Recycling) | Niagara Falls<br>Port Colborne<br>Welland<br>Thorold<br>Grimsby<br>Lincoln<br>Niagara-Lake<br>Pelham<br>Wainfleet<br>West Lincoln | 448,000 | 722,610 | 1,049,928 | 888,327 | 409,233 |
| Simcoe (North Simcoe Waste Mgmt Association) | Midland<br>Penetanguishene<br>Port McNicholl<br>Victoria Harbour<br>Tay<br>Tiny | 228,000 | 301,375 | 243,012 | 628,465 | 621,720 |

**Table 5.5**
**ESTIMATED EXPENDITURE ON RECYCLING PROGRAMS IN ONTARIO 1987 TO 1989 (Cont'd)**

| County | Municipality | 1987 | 1988 | | 1989 | |
|---|---|---|---|---|---|---|
| | | Cost ($) | Operating ($) | Capital ($) | Operating ($) | Capital ($) |
| Peterborough (Scotts Plains Recycling) | Peterborough | 592,470 | 493,750 | 2,640 | 572,748 | 13,596 |
| Simcoe (South Simcoe Waste Mgmt) | Alliston<br>Adjala<br>Bradford<br>Beeton<br>Cookstown<br>Tecumseth<br>Tosorontio | 14,400 | 125,325 | 293,370 | 490,809 | 122,430 |
| Hamilton/ Wentworth (Third Sector) | Hamilton<br>Stoney Creek<br>Ancaster<br>Dundas<br>Flamborough | 711,400 | 1,518,998 | 166,650 | 2,070,614 | 0 |
| Wellington (Wellington Recycling Group) | Fergus<br>Harriston<br>Mount Forest<br>Palmerston<br>Arthur<br>Clifford<br>Drayton<br>Elora<br>Erin<br>Arthur Twp<br>Eramosa<br>Erin<br>Guelph<br>Maryborough<br>Minton<br>Nocholl<br>Peel Twp<br>Pilkington<br>Puslinch<br>West Garafraxa<br>West Luther | 100,000 | 195,500 | 14,698 | 401,795 | 129,525 |
| | COBIS - MRRP Program | | | | 117,184 | |
| | Subtotal | 9,975,768 | 14,159,162 | 15,955,889 | 25,764,792 | 16,803,380 |
| | Total | 9,975,768 | 30,115,051 | | 42,568,172 | |

## Table 5.6
## MINISTRY OF THE ENVIRONMENT
## PUBLIC EXPENDITURES REPORTED IN THE COBIS REPORT

| Program | Grants From The MRSP | | | Reduction/Reuse |
|---|---|---|---|---|
| | 1986-1987 | 1987-1988 | 1988-1989 | 1988-1989 |
| **Corporations** | | | | |
| Durham Recycling Centre Inc. | $160,245 | | | |
| Essex Region Conservation Authority | $301,569 | | $635,676 | |
| Grey Bruce Waste Recycling | $65,000 | $76,000 | | |
| Niagara Employment Agency | $184,000 | $218,526 | $260,949 | |
| North Simcoe Waste Management Assoc. | $132,000 | $121,353 | $118,800 | |
| Scott's Plains Recycling Inc. | $43,004 | $196,626 | $181,481 | |
| Muskoka Recycling Association | | | $56,865 | |
| South Simcoe Waste Management Assoc. | | | $45,117 | |
| Third Sector Recycling | | $276,000 | $411,076 | |
| Wellington Recycling Group | | | $60,007 | |
| West Northumberland Recycling Group | $49,000 | $70,480 | $109,499 | |
| **Regions** | | | | |
| Durham | $326,000 | $189,000 | $488,360 | |
| Halton | $1,079,231 | $197,403 | $43,006 | |
| Metropolitan Toronto | | | $30,000 | |
| **Cities** | | | | |
| Brampton | $196,327 | $314,000 | $360,208 | |
| Brockville | | | $33,154 | |
| Cambridge | | $104,305 | $161,537 | |
| Guelph | $36,134 | $164,977 | $219,370 | |
| Mississauga | $449,167 | $535,452 | $414,432 | |
| Ottawa | | $282,317 | $305,851 | |
| St. Catherines | | | $127,500 | |
| Stratford | | $37,055 | $33,382 | |
| Waterloo | | | $63,820 | |
| **Towns** | | | | |
| Fort Erie | | | $30,030 | |
| Markham | | | $163,930 | |
| Richmond Hill | | | $76,554 | |
| **Townships** | | | | |
| Innisfil | | | $35,138 | |
| Cumberland | | | $51,048 | |
| Georgian Bay | | | $62,500 | |
| **Total** | $3,021,677 | $2,783,494 | $4,579,290 | $58,592 |

Source: COBIS

## Table 5.7
## RECYCLING MARKET PRICES PAID: 1988 TO 1990

| Product | 1988 ($/tonne)* | 1989 ($/tonne)* | 1990 ($/tonne)* |
|---|---|---|---|
| Newspaper | $40-45 | $45 - first 20-30%<br>$9-15 - remaining | $7-12** |
| Glass | $60 sorted<br>$40 mixed | $60 sorted<br>$35 mixed | $60 sorted<br>$0-15 mixed |
| Steel | $75 | $70 | $70 loose<br>$90 densified |
| Aluminum | | $1200 baled | $1400-2000 baled |
| PET | $400 baled<br>$200 unbaled | $400 baled<br>$200 unbaled | $300 baled<br>$125 unbaled |

* Prices shown are in current dollars and do not take inflation into account.
**Price determined by export markets due to labour dispute at Ontario de-inking mill.

Source:

- OMMRI, February, 1990.
- Personal communications with RCO, September/October 1990.

Table 5.8 summarizes available cost data, along with estimated revenues from the sale of collected materials.

It is interesting to note that despite the additional support provided by the Ministry of Northern Development and Mines' (MNDM) Municipal Recycling Support Program, by the end of 1989 only one northern community, Dryden of Kenora District, had taken advantage of the grant.

### 5.2.4 Future Trends

Riding on the successes of the Blue Box program, the Ministry of the Environment and OMMRI have taken the opportunity to expand the program to encompass a larger portion of the population. Funding has been set aside to help multi-unit buildings, schools, commercial businesses and industries to divert their solid wastes from landfill to recycling programs. A special grant has also been introduced to further supplement the costs incurred by northern communities during the initiation of a recycling program.

Municipalities are also being encouraged to expand the Blue Box program beyond the traditional four materials (newspaper, glass, metal and PET) to include other recyclable materials. Some municipalities have expanded their program to incorporate mixed plastic materials. The first program to collect mixed plastics began in Guelph in March 1989 and since then has been adopted by the larger Regions of Metropolitan Toronto, Peel, York, Halton and Niagara. Other communities have also included corrugated cardboard, phone books and household hazardous waste as part of their recycling programs.

A number of potential recyclable waste materials have graduated beyond the conceptual stage to the pilot project stage. Currently, a handful of municipalities have begun pilot projects to test the feasibility of recycling film plastic, boxboard, magazines and fine paper. These initiatives are summarized in Table 5.9.

One material in particular that has received a great deal of attention over the past year is that of organic waste. To date, many municipalities have tackled the problem of recycling kitchen and yard waste by offering, free-of-charge or on a cost-share basis, individual composters to households. As of June 1989, seventeen municipalities were promoting home composting activities.

Recently, a few municipalities have begun experimenting with a compost collection and centralized processing scheme in which kitchen and/or yard wastes are captured through the curbside recycling program and processed at large, specially engineered composting facilities. Demonstration participants include the City of Guelph, the City of Mississauga and Metropolitan Toronto. In one case, Guelph's wet/dry system is unique in that it is the first program in North America that endeavours to collect organic kitchen waste at the curbside. Residents are requested to separate their wastes according to a two stream collection system (two containers for wet wastes and dry

## Table 5.8
## ESTIMATED COSTS AND REVENUES OF RECYCLING PROGRAMS IN ONTARIO
## (1987 AND 1989)

| Material | 1987 | | | | 1989 | | | |
|---|---|---|---|---|---|---|---|---|
| | Quantity Collected (tonnes) | Price *(a) | Revenue ($) | Cost | Quantity Collected (tonnes) | Price *(b) | Revenue ($) | Cost |
| News | 81,913 | $42.50 | $3,481,302 | | 155,904 | $20.25 | $3,157,056 | |
| Glass | 11,027 | $50.00 | $551,350 | | 31,360 | $47.15 | $1,478,624 | |
| Steel | 4,071 | $75.00 | $305,325 | | 17,024 | $70.00 | $1,191,680 | |
| Aluminum | - | - | - | | 1,613 | $1,200.00 | $1,935,600 | |
| PET | 36 | $300.00 | $10,800 | | 502 | $300.00 | $159,600 | |
| Total Quantity | 97,847 | | | | 206,403 | | | |
| Total Revenue | | | $4,348,777 | | | | $7,913,560 | |
| Total Cost | | | | $10,000,000 (c) | | | | $42,500,000 (d) |
| Net Cost | | | | $5,651,223 | | | | $34,586,440 |

*Average of price ranges in Table 5.7.

a) 1988 market prices used.
b) Assume 25% at $45, 75% at $12.
c) Capital and operating costs combined, no breakdown available
d) $16,803,380 capital cost.
$25,764,792 operating cost.

## Table 5.9
## STATUS OF INNOVATIVE RECYCLING PROGRAMS IN 1989

| County | Material | | | | |
|---|---|---|---|---|---|
| | Mixed Plastics | Composting | Old Corrugated Cardboard | Magazines | Telephone Books |
| Brant | Brantford-mixed | | | | |
| Bruce | | Port Elgin | | | |
| Kenora | | | | | |
| Dufferin | | | | | |
| Durham | yes | yes | depot | | |
| Essex | | | | | |
| Frontenac | | | | | |
| Grey | yes | | | | |
| Halton | | | yes | pilot | |
| Hamilton | | | | | |
| Huron | | | | | |
| Lambton | Sarnia-HDPE | | | | |
| Leeds-Grenville | | | | | |
| Lennox & Addington | | | | | |
| Metro Toronto | yes | yes | yes | | yes |
| Middlesex | | | | | |
| Muskoka/Haliburton | | | | | |
| Niagara | | Fort Erie | | | |
| Northumberland | | | | | |
| Ottawa-Carleton | | Kanata, Ottawa | | | |
| Oxford | | | | | yes |
| Peel | Mississauga-mixed | yes | depot | | Mississauga |
| Perth | | | | | |
| Peterborough | | | | | |
| Renfrew | | | | | |
| Simcoe | | Orillia, S.Simcoe | | | |
| Stormont-Glengarry | | | | | |
| Victoria | | | | | |
| Waterloo | Cambridge-LDPE | yes | | | |
| Wellington | Guelph-mixed | Guelph | Guelph | | Guelph |
| York | | | Richmond Hill | | |

Sources: OMMRI, 1990
RIS, 1990
SWISC, 1990
MacLaren Engineers, Inc. in-house files

wastes) or a three stream collection system (three containers for organics, recyclable materials and non-recycled garbage). Initial results show the need to reduce confusion over the complexity of the program by designating easy to use and readily identifiable containers.

In Ontario, as elsewhere in North America, recycling markets have been supply driven and although municipalities have been guaranteed markets for their recyclable materials (assuming they meet end user standards), the prices continue to decline, as illustrated in Table 5.7. Despite the abundant supply of recyclable materials recovered through municipal recycling programs, the recycling market has been slow to respond to the changing market forces. This situation has played havoc with municipal recycling programs and the materials being diverted through the Blue Box program, for example:

- **Newspapers** - Newspapers are presently being stockpiled in warehouses or sold for export for extremely low prices as a result of a strike at Quebec and Ontario Paper Company's de-inking mill. Since this is the only fully operating de-inking mill in Ontario, municipalities have little opportunity to switch to other de-inking mills while the strike is in progress. Market forces do not work in the municipalities' favour under this monopsonistic (single buyer) situation. Up to now, municipalities had to rely on one company to set fair prices and to guarantee acceptance of all recovered newspapers. This situation will change in the near future. Four new de-inking facilities are being planned which can accept newsprint from the Ontario market. These are:

  - Atlantic Packaging, Whitby
  - Canadian Pacific Products
    - Thunder Bay
    - Gatineau, Quebec
  - Diashowa, Quebec City (1992)

  Abitibi Price are also considering construction of de-inking plants (Reference: Colin Johnston, Quebec and Ontario Paper Company).

- **Glass** - The glass recycling market also operates in a monopsonistic (single buyer) setting in which competitive forces do not come into play. The onus has been placed on municipalities to meet glass sorting specifications as occurred in January, 1990 when Consumers Glass introduced a new pricing schedule to encourage municipalities to source separate. In order to receive the higher purchasing price for sorted glass, municipalities have had to retrofit existing collection vehicles or purchase new ones which permit separation of glass at the source. Under present market circumstances, little incentive exists to improve the processing system at the recycling plant. Municipalities are also facing the problem

associated with material contamination. Recent increases in volumes of materials recovered from municipal curbside and depot recycling programs have been accompanied by increased levels of contamination in the glass supply, reflected in lower purchasing prices.

The recycling market has been slow to meet the growing supply of recycled materials by increasing the number of end users. Slowly, though, this situation is changing. New end users of the recycled materials have begun to penetrate the market causing the recycling market to shift from its characteristic supply driven state to a demand driven one. For example, the Atlantic Packaging de-inking mill is now operational in Whitby. Other examples are cited in Section 3.4.2. In addition, some local governments have taken on the responsibility of encouraging market activity by passing bylaws that promote product stewardship. The City of Toronto recently passed a bylaw, effective July 1991, that prohibits the sales of newspapers not containing a minimum 50% recycled content through vending machines. It is hoped that the current short-term state of market underdevelopment will be resolved over the long-term as recycling becomes an essential component of society's waste management activities.

A more comprehensive discussion of 3R's markets is provided in RIS *Market Assessment of 3R's Activities in Ontario, 1991.*

## 5.3 MATERIAL RECOVERY FACILITIES

### 5.3.1 General Description

Over the past decade, residential and industrial/commercial institutional (ICI) recycling activities have become integral components of Ontario's waste management system. Responding to the flow of materials diverted from landfills, communities have had to construct material recovery facilities (MRFs).

"A MRF is an intermediate processing centre where collected, mixed, recycled solid waste materials are separated into marketable, industrial 'feedstocks' for use in the manufacture of new products. MRFs can process glass, metals, plastics, and mixed grades of paper" (Combs, 1990). In order to change wastes into marketable material, MRFs perform several activities. The number and degree to which these tasks are performed, and the types of materials which are processed vary from facility to facility, but generally include:

- sorting/separation, and
- processing, including shredding, baling, crushing and granulation.

For each process, there are specific types of equipment which must be used. The types of equipment can be classified into three main categories:

- sorters
- balers/densifiers, and
- shredders/granulators

Sorting can be done manually or with sorting machines. There are mechanical sorters available for materials such as plastic pop bottles and ferrous and non-ferrous metals. However, separating of coloured glass, and magazines from newspapers and other papers is still performed manually in most cases.

In the case of many mixed plastics, and various grades of paper, shredders and granulators are used, to make the material more attractive to end-users. Similarly, glass is often crushed at the facility before distribution to end users, as well. This process allows more material to be transported in one container; and therefore, reduces haulage rates for the end-user of the materials. After breaking down the materials, some of them are baled, as in the case of newspapers, plastic bottles and metal cans. Once materials have undergone these various processes, they are distributed to end users.

A MRF designed to provide these services for municipal and commercial waste materials targeted for recovery will generally include receiving areas for incoming materials segregated by type, areas for processing equipment, upgrading and quality control, and shipping and post-processing storage until time of shipment. Adjacent to the warehouse portion of the building are offices and staff facilities (please refer to Figure 5.3).

Presently, MRFs process a variety of recycled materials originating from the residential sector. Traditional "Blue Box" recycling materials include newspapers, glass, tin, aluminum and PET containers. Some municipalities may also process corrugated cardboard and other plastics.

Depending on the design of the ICI recycling program, materials such as fine paper and corrugated cardboard may be collected and processed by end-user companies or sent to the MRF for processing and distribution.

### 5.3.2 Physical Dimensions

Presently in Ontario, there exist 31 MRFs, most of which are located in South Central Ontario. Facilities may be operated by one of three agents - the municipality, private sector or third sector. Third sector groups are those companies that are characterized as non-profit interest organizations. In general, most MRFs are owned and operated by private companies such as Laidlaw Waste Systems Ltd. and McLellan Waste Disposal. These two companies alone own and operate eight MRFs, servicing the

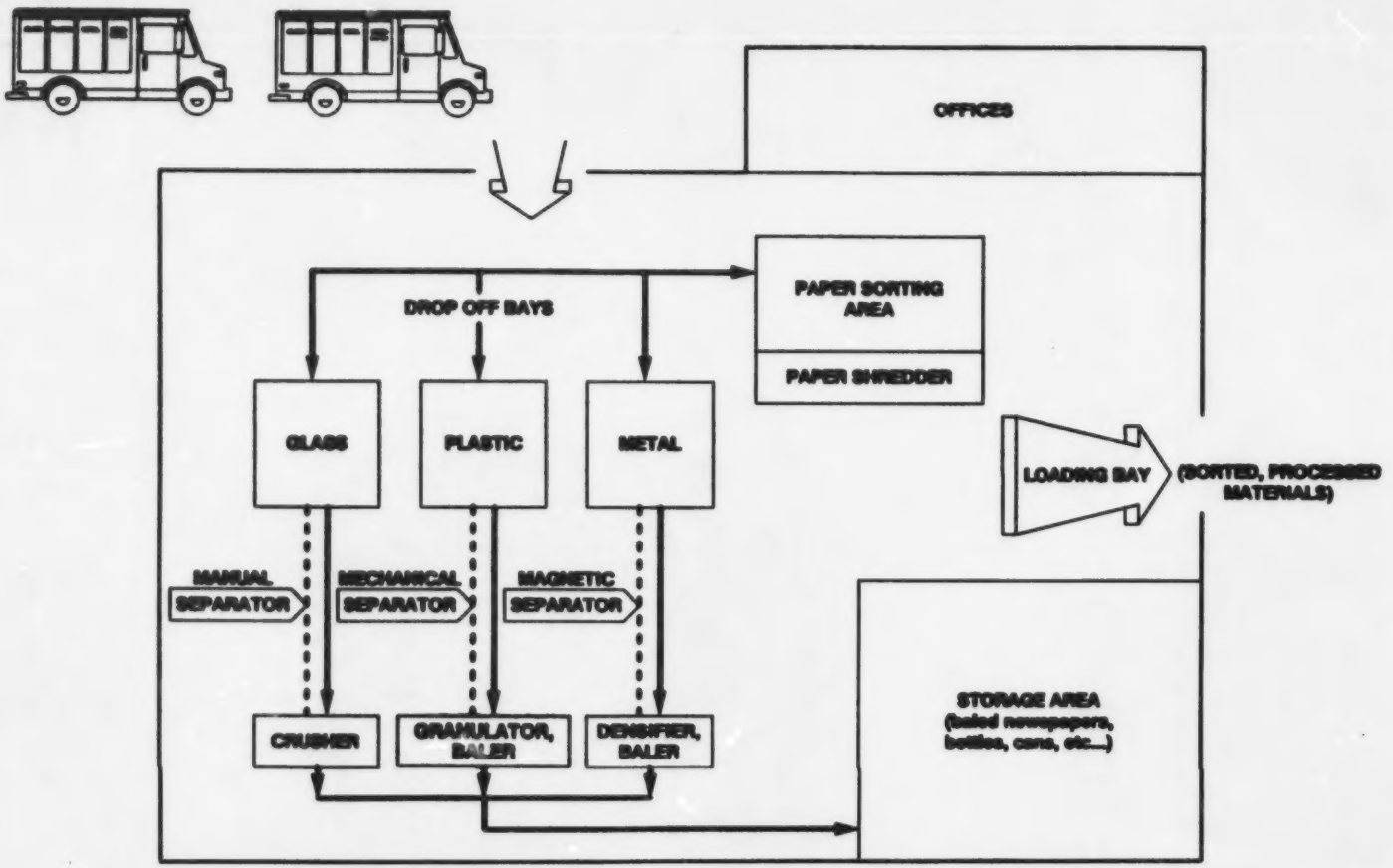



**Figure 5.3**
**SIMPLIFIED MRF SCHEMATIC**

Cities of Barrie, Guelph, Kingston, Kitchener, Mississauga, Mount Forest and Ottawa. Of the remaining 23 facilities, 12 are operated by smaller private companies, seven are operated by third sector groups and four are operated by the municipality. Figure 5.4 presents a pie chart of these figures.

Larger municipalities tend to have a facility built within their boundaries and permit surrounding communities to use their facility. This arrangement exists in the Cities of Guelph, Windsor, Mount Forest and Stratford. In remote areas that lack a large central community, municipalities may pool their resources and develop a recycling program servicing a large area. Included in this category are the following programs: Muskoka Recycling Association, North Simcoe Waste Management Association, Northumberland Recycling and Bluewater Recycling Association.

Of the 31 operating MRFs surveyed recently by VHB, 14 respondents indicated that they employed a total of 308 full time and 17 part time staff. Nine of these facilities started their operations after 1987.

Although the types of material handled by MRFs differs, the 14 facilities surveyed are fairly consistent in their acceptance of typical Blue Box materials, as would be expected. Non-traditional items such as organic wastes, tires and wood are handled by a far smaller portion of the MRFs surveyed. Table 5.10 presents a complete listing of the materials handled by the facilities surveyed.

### 5.3.3 Economic Dimensions

As with recycling programs, little detailed information on costs has been compiled for MRFs. This is in part due to the speed at which they have started up in Ontario and in part due to the sensitive nature of this information to the private sector.

Generic capital and operating costs were obtained for a MRF, having a capacity of 6,600 tonnes year, from a report prepared by CH2M Hill of Boston for Brattleboro, Vermont, April 1990 (See Table 5.11). Equipment prices were increased 20% to reflect the exchange rate from U.S dollars to Canadian currency. Employee salaries were upgraded to reflect current market rates.

Table 5.11 shows that estimated capital costs (excluding land values) are $127/tonne/year capacity. Operating costs are estimated at $54/tonne.

### 5.3.4 Future Trends

As waste management evolves, some municipalities are considering comprehensive waste handling systems in which all facilities associated with waste management are housed in a common area. As an example, the Region of Waterloo has pursued this system design and is presently constructing a material recovery facility adjacent to a

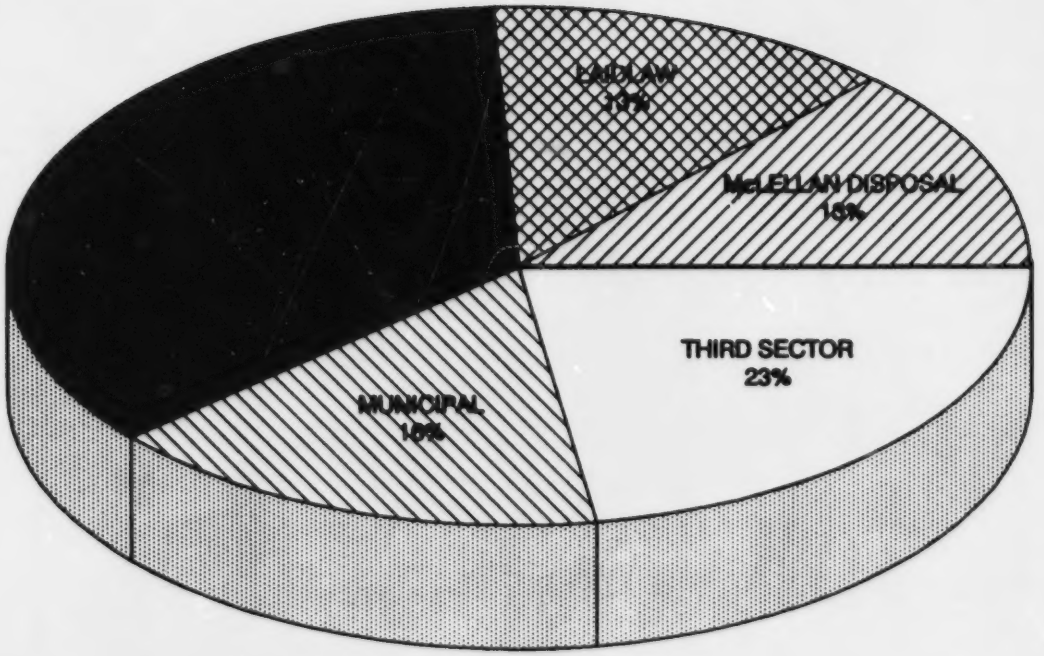



**Figure 5.4**
**PRIVATE, MUNICIPAL & THIRD SECTOR OWNERSHIP OF MATERIAL RECYCLING FACILITIES (IN PERCENT)**

**Table 5.10**
**WASTE TYPES HANDLED AT MATERIAL RECOVERY FACILITIES**

| Components Handled By Material Recovery Facilites (MRF's) | Number of MRF's Accepting | Percentage of Survey Response |
|---|---|---|
| Composite Packaging | 5 | 36% |
| Old Corrugated Cardboard (OCC) | 8 | 57% |
| Construction/Demolition Wastes | 2 | 12% |
| Galss (Food and Beverage Containers) | 14 | 100% |
| Household Hazardous Wastes | 2 | 14% |
| Aluminum (Foil) | 3 | 21% |
| Aluminum (Food and Beverage Containers) | 13 | 93% |
| Steel (Food and Beverage Containers) | 14 | 100% |
| Mixed Paper and Magazines | 5 | 36% |
| Telephone Books | 5 | 36% |
| Newsprint | 13 | 93% |
| Fine Paper | 9 | 64% |
| Boxboard | 3 | 21% |
| Plastics (Rigid) | 7 | 50% |
| Plastics (Film) | 6 | 43% |
| Diapers | 1 | 7% |
| Yard Wastes | 2 | 14% |
| Wood Wastes | 3 | 21% |
| Used Tires | 1 | 7% |
| White Goods | 2 | 14% |
| Food Wastes | 1 | 7% |
| Other | 1 | 7% |

Source: VHB Survey, 1990

**Table 5.11**
**GENERIC COST FOR 6,600 TONNE PER YEAR MATERIAL RECYCLING FACILITY**

| Capital Cost | Variable |
|---|---|
| **Site and Building** | |
| Land Aquisition | $0 |
| Site Preparation | $30,000 |
| Building, 25m x 30m, 4.5m Eave Height (750 sq. m) | $500,000 |
| Metal Sides and Roof on Concrete Subfloor | |
| with complete mechanical and electrical systems | |
| **Subtotal - Site and Building** | $530,000 |
| **Processing Equipment** | |
| Balers(2)(Paper,Plastic,Cans) | $22,000 |
| Chopper/Baler (Newspaper) | $10,000 |
| Crusher (Glass) | $17,000 |
| Conveyors, 5 m x 1 m (2) | $36,000 |
| Magnetic Separator | $13,000 |
| Forklift, Front-end Loader, with attachements | $35,000 |
| Chipper (Yard Wastes) | $22,000 |
| Contingency | $54,000 |
| Recycling Vehicles (1) | $100,000 |
| **Subtotal - Processing Equipment** | $309,000 |
| **Total Capital Cost** | $839,000 |
| **Operation and Maintainance** | |
| Labour (includes 25% fringe benefits) | |
| Conveyor line operators (3) | $75,000 |
| Equipment operators (2) | $70,000 |
| Administrative assisstant (1) | $28,000 |
| Supervisor | $45,000 |
| **Subtotal - Labour** | $218,000 |
| **Overhead** | |
| Maintainance | $50,000 |
| Electricity | $25,000 |
| Fuel, etc. | $25,000 |
| Administration | $15,000 |
| Insurance | $25,000 |
| **Subtotal - Overhead** | $140,000 |
| **Total Operating Cost** | $358,000 |

Source: CH2M HILL INC. and ENVIROLOGIC INC., 1990.

household hazardous waste facility, a centralized composting facility and an ICI material drop-off area. This approach promotes more effective and efficient administration.

MRF operations and recycling collection programs are expanding as new technology and markets are developed to process and recycle an increasing range of materials. New programs have already been initiated in some areas, for example, magazine recycling in Halton and mixed plastics recycling in Mississauga. Consideration is also being given to special facilities designed to process "non-traditional" materials such as wood, tires and construction wastes. The Peel Region wood recycling facility is an example of these developments. "As markets are developed, and legislation passes for landfill bans, MRFs of tomorrow will recover and process an increasing variety of residential, commercial, demolition and household hazardous wastes", (Waste Age, 1990).

An active future is predicted for material recovery facilities. New markets are being discovered and existing ones expanded as recycling becomes a more acceptable and indeed, integral part of Ontario's waste management infrastructure. MRFs will play an increasingly important role as processors and distributors in the system as municipalities and businesses work towards the waste diversion targets set out by the MOE.

## 5.4 PRIVATE AND THIRD SECTOR RECYCLING AGENTS

### 5.4.1 General Description of Industry

The recycling industry in Ontario is comprised of both private businesses and interest groups which may be non-profit and/or staffed by volunteers. The latter of these two enterprises has been referred to as the third sector of the recycling industry. This subsection describes in general terms how recyclers operate and where they fit into the flow of economic goods and services.

Unfortunately, businesses involved in recycling activities do not fit clearly into the traditional breakdown of standard industrial classifications. However, information has been collected from a number of sources in an attempt to generate a clearer picture of their economic interactions. Definitions of the various players in the recycling sector have been developed by Recoup's Canadian Recyclers Directory, and these are paraphrased below:

**Generators** - Any source of any type of recyclable materials.

**Collectors** - Small, often one-man, part-time operations, which collect small quantities of recyclable materials from local sources for sale to dealers.

**Dealers** - Operations who accumulate recyclable materials, sometimes from collectors, sort them manually and mechanically, and offer them for sale to brokers and processors.

**Brokers** - Agents for processors/consumers of recyclable materials, who, for a fee, guarantee to obtain the quantity of materials required and delivery of the same. Usually associated directly with processors.

**Processors** - Companies which convert recyclable materials to meet the specifications of consumers. Large equipment such as shredders, balers and presses may be used.

**Consumers** - Those companies which may use both virgin and recycled materials as feed. Examples include pulp and paper mills, glass manufacturing and steel mills. Another term often used is end users.

Depending upon the material being considered, any or all of the above players may be involved, and the same company may fill a number of roles. In this study, the generic term used to describe collectors, dealers, brokers and processors, whether they operate municipal programs or in the private sector, is *recycling agents*.

### 5.4.2 Physical Dimensions

Three principal sources of information were used to develop data on the size of the recycling industry in Ontario, as described in Section 2.7. The first was information from Dun and Bradstreet, the second was a RCO study of municipal recycling programs and the third was Recoup's Canadian Recyclers Directory.

The major source of data on recycling agents was Dun & Bradstreet, who provided information on two SIC groups which cover recycling agents. The first SIC was 4953 (Refuse Systems) which covers establishments engaged in recycling of waste materials and also covers haulers as noted in Section 4.5. The second was SIC 5093 (Wholesale of Scrap and Waste Materials) which includes establishments engaged in automotive wrecking for scrap, bag reclaiming, scavengering and wholesales of the following wastes:

- waste bottles, boxes, oil, textiles and rags
- iron and steel, nonferrous metals and rubber scrap
- general line of junk and scrap.

From these descriptions, it appears that all types of agents including collectors, dealers, brokers and processors would be included in these two groups.

As discussed in Section 4.5, a telephone survey of companies listed in SIC 4953 was conducted by Dun & Bradstreet (D & B). Of 295 companies listed with D & B, 65 participated in the survey. Information on these 65 firms will be discussed first, followed by information on the remaining 230, which was limited to D & B's existing database.

Thirty four of the surveyed firms identified themselves as involved in the processing of recycled materials. The vast majority, 25 (74%), are also involved in hauling or other activities as summarized in Figure 4.8 of the previous chapter.

Thirty three (33) firms reported employment totalling 486. Figure 5.5 presents the distribution of companies based on amount of recyclable materials handled.

The sources of recycled materials were also identified. Distribution of reported composition by source (commercial, industrial or residential) is summarized in Figures 5.6 to 5.8. From these figures, it is evident that the companies in this survey handle predominately commercial and industrial wastes.

Table 5.12 summarizes materials processed by the reporting companies.

**Table 5.12**
**MATERIALS PROCESSED BY AGENTS SURVEYED**

| Recycled Material | Number of Companies Reporting Processing |
|---|---|
| Aluminum | 13 |
| Corrugated Cardboard | 8 |
| Drywall | 3 |
| Fine/Office Paper | 8 |
| Glass | 5 |
| Newspaper | 5 |
| Plastic | 10 |
| Rubber Tires | 4 |
| Tinplate Steel | 6 |
| Wood Waste | 4 |
| Liquid Waste | 6 |
| Miscellaneous Metal | 2 |
| Other | 2 |

Source: Dun and Bradstreet, 1990

## Figure 5.5
## DISTRIBUTION OF COMPANIES BY AMOUNT OF RECYCLED MATERIALS HANDLED
## (31 COMPANIES Responding)

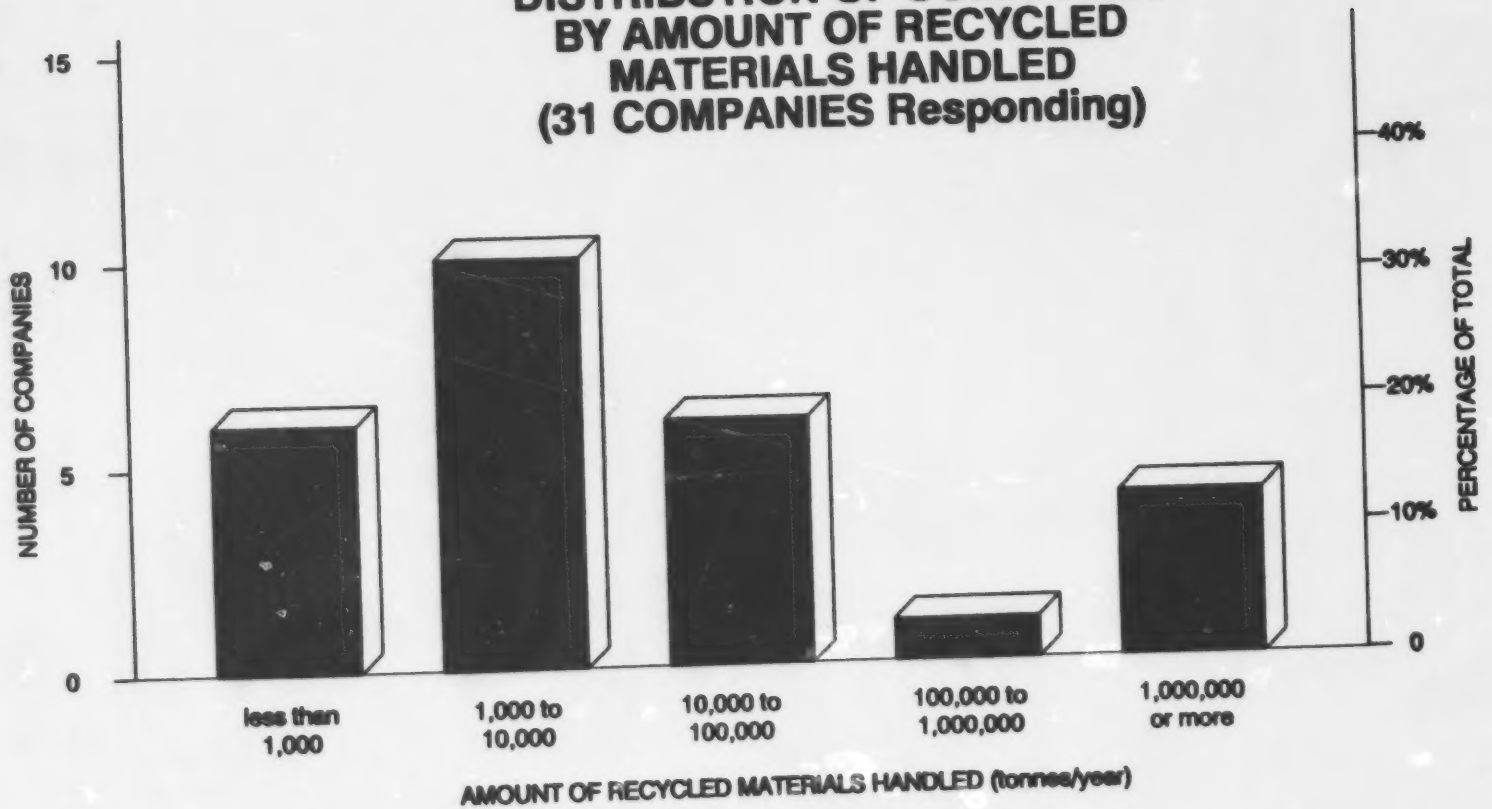


**Figure 5.6**
**DISTRIBUTION OF COMPANIES BY FRACTION OF COMMERCIAL SOURCE MATERIALS**
**(34 Companies Responding)**

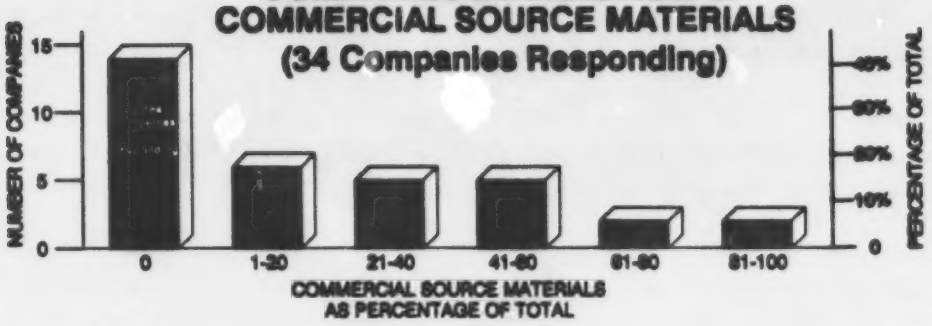



**Figure 5.7**
**DISTRIBUTION OF COMPANIES BY FRACTION OF INDUSTRIAL SOURCE MATERIALS**
**(34 Companies Responding)**

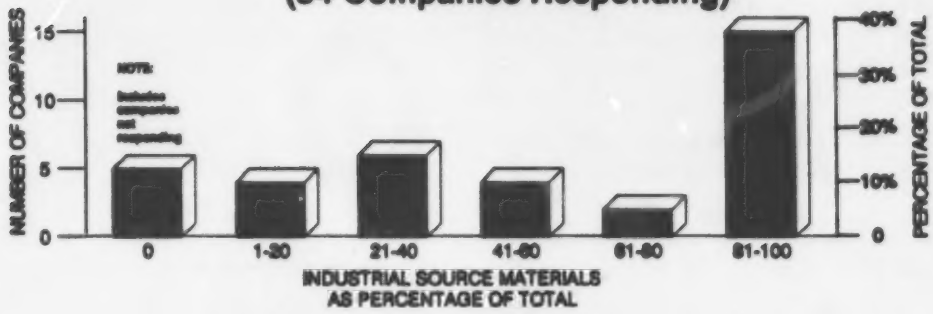



**Figure 5.8**
**DISTRIBUTION OF COMPANIES BY FRACTION OF RESIDENTIAL SOURCE MATERIALS**
**(34 Companies Responding)**

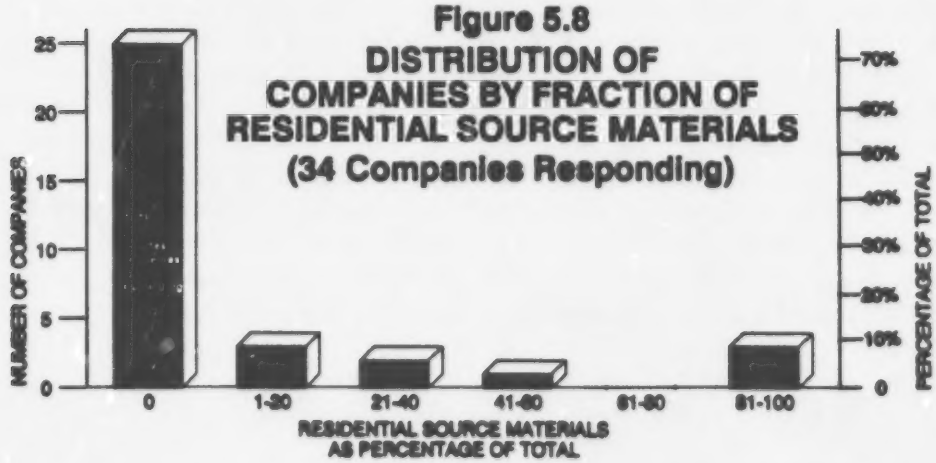


Table 5.13 summarizes the municipalities served by the reporting companies. Information on equipment is use was also solicited, and is summarized in Table 5.14.

The only information on physical dimensions for the remaining 230 companies in SIC 4953 is employment. Twenty-four firms (96%) of 25 firms who list waste recycling as their primary activity reported employment totalling 570.

The information in SIC 5093 (Wholesale of Scrap and Waste Materials) covers 285 companies. All 285 companies report 5093 as their primary SIC classification. It is interesting to note that only five of the companies report SIC 4953 (Refuse Systems) as a secondary SIC.

Two hundred and eighty-two companies (99%) reported employment figures, totalling 2,830 for the Ontario branch offices reporting. Figure 5.9 presents a bar chart of the distribution of the number of employees. 220 firms (77%) have fewer than 10 employees. Two hundred and seventy two companies (95%) also reported a total employee figure, which includes employees outside Ontario and in other subsidiaries not in SIC 5093. The total of these figures is 3,389 employees.

Table 5.15 summarizes the year of start-up for the 285 firms. While the number of firms started in the 1980's is almost as high as the number of those which have survived since before 1970, the younger firms tend to be smaller as noted in Table 5.15.

The data on this SIC is stored in the database SIC5093.DBF. It is made up of the standard information kept on file by Dun & Bradstreet, referred to as the "Canadian DMI System Tape Record".

The second source of information is the recycling agent database which was compiled from the 1987 RCO study of municipal recycling programs and was supplemented with up-to-date information from the MOE Waste Management Branch and the VHB/ MacLaren survey of materials recovery facilities. In 1987, 88 municipalities were served by 98 active recycling programs. A total of 80 recycling agents, both active and inactive, were identified from all information sources. Thirty, or 37.5%, were private sector agents and twenty four, or 30%, were from the third sector. The remaining twenty six, or 32.5%, were municipal agents. Examples of recycling agents are Laidlaw Waste Systems, a private agent; the Whitchurch-Stouffville Recycling Group, a third sector agent and the Region of Peel, a municipal agent. There were 52 active recycling agents in 1987 employing 287 full- or part-time staff, 10 of whom were physically or mentally challenged, and 207 volunteer workers. Other information on the amounts of materials handled and the municipalities served by these programs is summarized in Section 3.4.

| Table 5.13<br>MUNICIPALITIES SERVED BY AGENTS SURVEYED | |
|---|---|
| **Municipality** | **Number of Agents Reporting Service** |
| Ajax | 7 |
| Barrie | 4 |
| Belleville | 2 |
| Brampton | 5 |
| Brantford | 4 |
| Burlington | 4 |
| Caledon | 2 |
| Cambridge | 5 |
| Chatham | 7 |
| Cornwall | 2 |
| East York | 4 |
| Etobicoke | 5 |
| Guelph | 1 |
| Halton Hills | 3 |
| Hamilton | 3 |
| Kingston | 1 |
| Kitchener | 2 |
| London | 1 |
| Markham | 1 |
| Milton | 2 |
| Mississauga | 3 |
| Newcastle | 2 |
| Newmarket | 2 |
| Niagara Falls | 2 |
| North York | 3 |
| Oakville | 2 |

| Table 5.13<br>MUNICIPALITIES SERVED BY AGENTS SURVEYED | |
|---|---|
| **Municipality** | **Number of Agents Reporting Service** |
| Oshawa | 3 |
| Ottawa | 3 |
| Peterborough | 1 |
| Pickering | 3 |
| Richmond Hill | 1 |
| Sault Ste. Marie | 1 |
| Scarborough | 1 |
| St. Catharines | 1 |
| Toronto | 6 |
| Windsor | 6 |
| Whitby | 2 |
| York | 1 |
| Other | 2 |
| Source: Dun & Bradstreet, 1990 | |

| Table 5.14<br>SUMMARY OF RECYCLING EQUIPMENT IN USE<br>BY AGENTS SURVEYED | | | |
|---|---|---|---|
| Equipment | Number in Use | Number of Companies Using | Number of Companies Using Equipment Manufactured in Ontario |
| Air Classifiers | 10 | 6 | 3 |
| Balers | 141 | 15 | 9 |
| Conveyors | 206 | 15 | 13 |
| Glass Crushers | 0 | 0 | 0 |
| Paper Shredders | 12 | 8 | 4 |
| Magnetic Separators | 46 | 11 | 7 |
| Metal Densifiers | 8 | 4 | 1 |
| Metal Flatteners | 4 | 3 | 2 |
| Plastic Granulators | 11 | 4 | 2 |

| Table 5.15<br>SUMMARY OF EMPLOYMENT IN SIC 5093 FIRMS BY START-UP YEAR | | | | |
|---|---|---|---|---|
| Start-up Year | Number of Firms | Percentage of Firms | Total Employees | Average Number of Employees per Firm |
| pre-1970 | 108 | 37.9 | 1275 | 11.8 |
| 1970-1979 | 76 | 26.7 | 761 | 10.0 |
| 1980-1989 | 89 | 31.2 | 665 | 7.5 |
| Not reported | 12 | 4.2 | 129 | 10.8 |
| All | 285 | 100.0 | 2,830 | 9.9 |

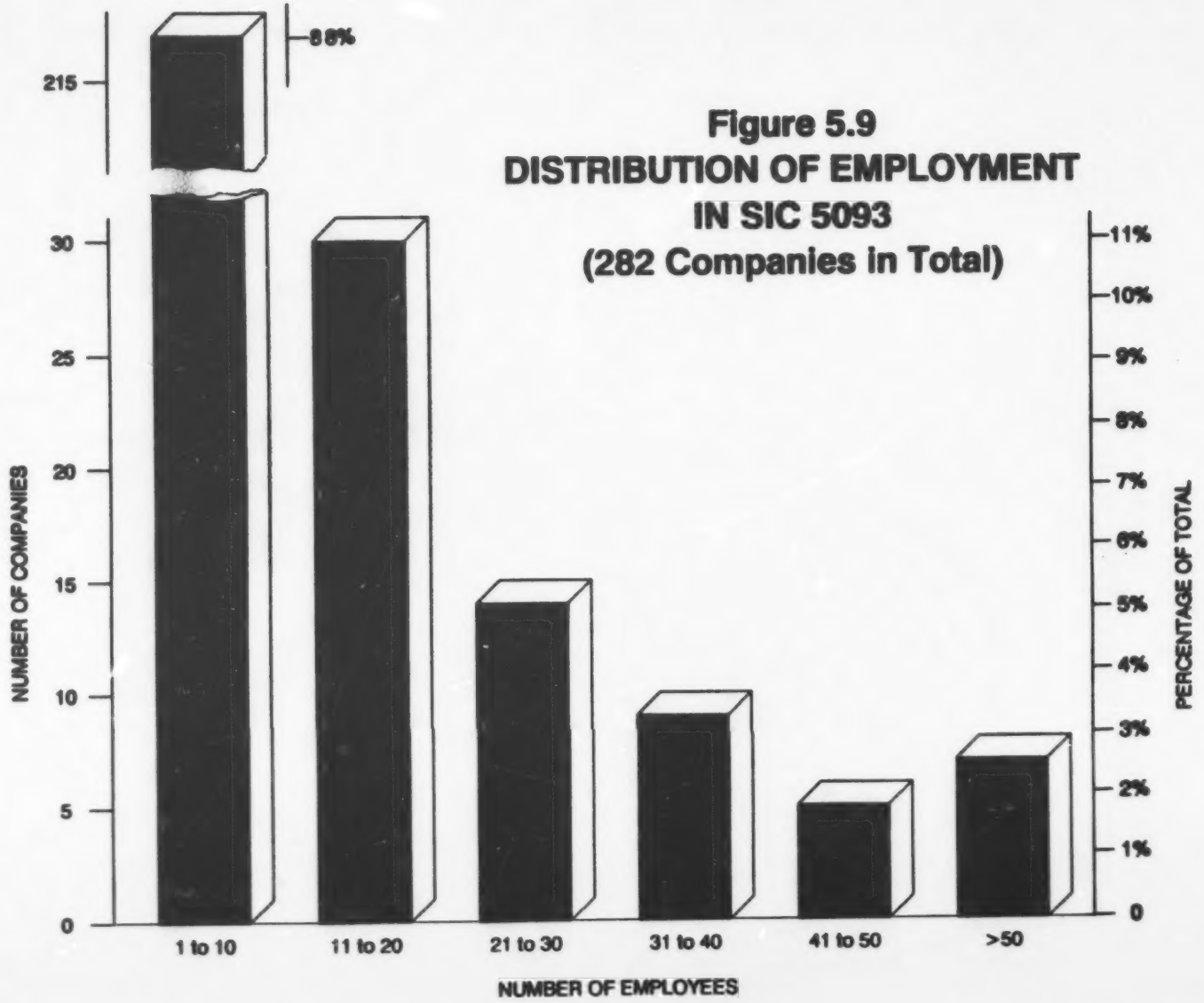



**Figure 5.9**
**DISTRIBUTION OF EMPLOYMENT**
**IN SIC 5093**
**(282 Companies in Total)**

Finally, the database compiled from the 1987 Recoup's Canadian Recyclers Directory lists 295 agents. Most of these are described by their function as well as materials handled. This information is summarized in Tables 5.16 and 5.17. Unfortunately, not all of the records include such information.

### 5.4.3 Economic Dimensions

The Dun & Bradstreet information has been the major source of economic data on recycling agents.

Once again, results for the 65 companies participating in the telephone survey are discussed first. Twenty of 34 companies identified as agents reported annual sales figures totalling $16,648,000. Figure 5.10 presents a distribution of companies by percentage of business in Ontario. Figure 5.11 illustrates percentage of business recycling represents.

Some limited information on prices charged by recycling agents to sources of recycable materials was also available from the survey results and is summarized in Table 5.18. Note that it was not possible to distinguish between no response and a response of $0/tonne. In general, it should be assumed that $0/tonne means that a response was not provided.

Figure 5.12 summarizes operating costs.

The only economic data on the remaining 230 companies in SIC 4953 are annual sales figures. For these 25 firms listing "Recycling Waste" as their primary activity, 10 firms (40%) reported sales figures totalling $32,980,000.

In SIC 5093, 141 companies (49%) reported annual sales figures totalling $558,455,500.

### 5.4.4 Future Trends

One important barometer of future trends for recycling agents is the opinion of those in the business. The survey conducted for this study by Dun & Bradstreet asked two questions soliciting the opinion of recycling agents on their future business. It is important to note that responses to questions of this nature tend to be somewhat optimistic, but do reflect the climate of business.

Thirty six recycling agents responded to Question 4 of the survey which read:

> In the future, as more waste reduction, reuse of materials, and recycling programs are implemented, how do you see the growth of your business? Do you think your business will have:

| Table 5.16<br>SUMMARY OF RECYCLING FUNCTIONS FROM RECOUP'S CANADIAN RECYCLERS DIRECTORY | | |
|---|---|---|
| **Recycling Function** | **Number of Agents** | **Percentage of Agents** |
| Dealer | 33 | 11.1% |
| Broker | 32 | 10.8% |
| Processor | 21 | 7.1% |
| Consumer | 4 | 1.3% |

| Table 5.17<br>SUMMARY OF MATERIALS HANDLED FROM RECOUP'S CANADIAN RECYCLERS DIRECTORY | | |
|---|---|---|
| **Material** | **Number of Agents** | **Percentage of Agents** |
| Paper | 63 | 21.3% |
| Glass | 19 | 6.4% |
| Plastic | 66 | 22.3% |
| Metal | 158 | 53.5% |

1) Substantial growth
2) Slight growth
3) Stay the same
4) Slight loss of business
5) Substantial loss of business

Figure 5.13 uses a pie chart to summarize the percentage breakdown of responses. No company reported that they anticipated a substantial loss of business and slightly more than half anticipated substantial growth.

The same number of agents responded to Question 5, which read:

> In the future, as more waste reduction, reuse of materials, and recycling programs are implemented, how do you see your company's costs changing? Do you think your business costs will have:

**Figure 5.10**
**DISTRIBUTION OF COMPANIES BY FRACTION OF BUSINESS IN ONTARIO**
**(36 Companies Responding)**

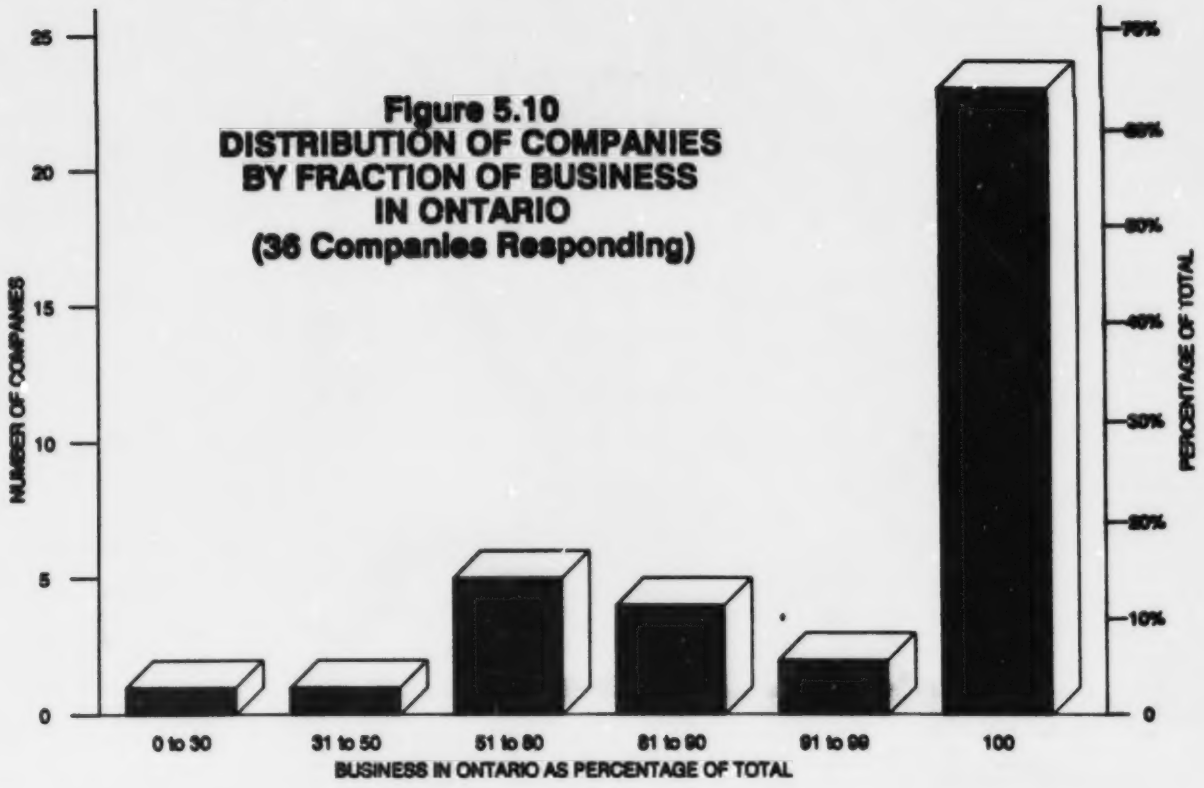
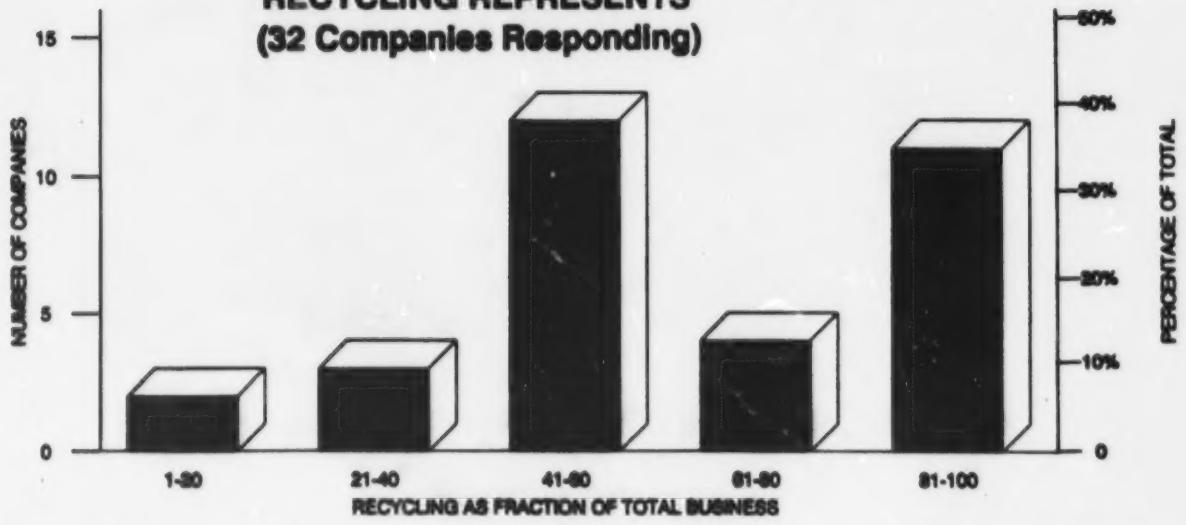
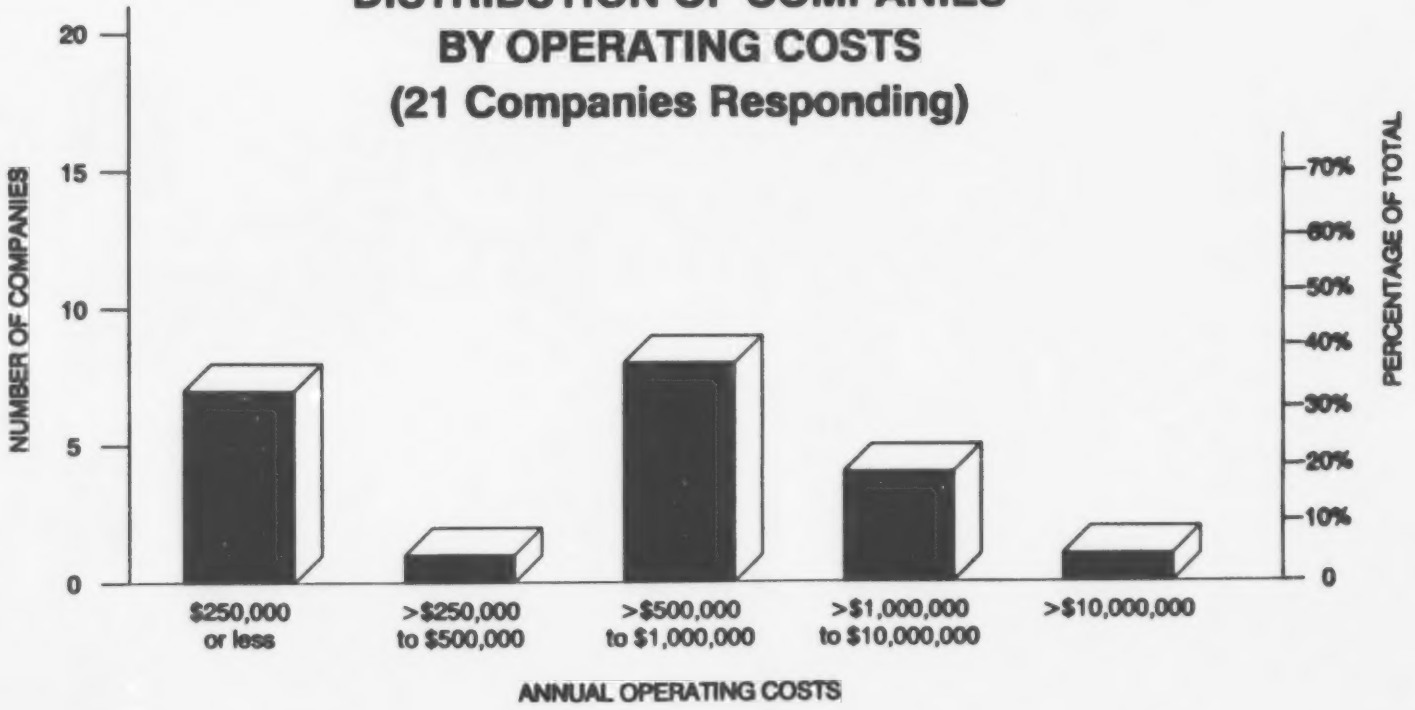



**Figure 5.11**
**DISTRIBUTION OF COMPANIES BY FRACTION OF BUSINESS RECYCLING REPRESENTS**
**(32 Companies Responding)**



## Figure 5.12
## DISTRIBUTION OF COMPANIES BY OPERATING COSTS
## (21 Companies Responding)



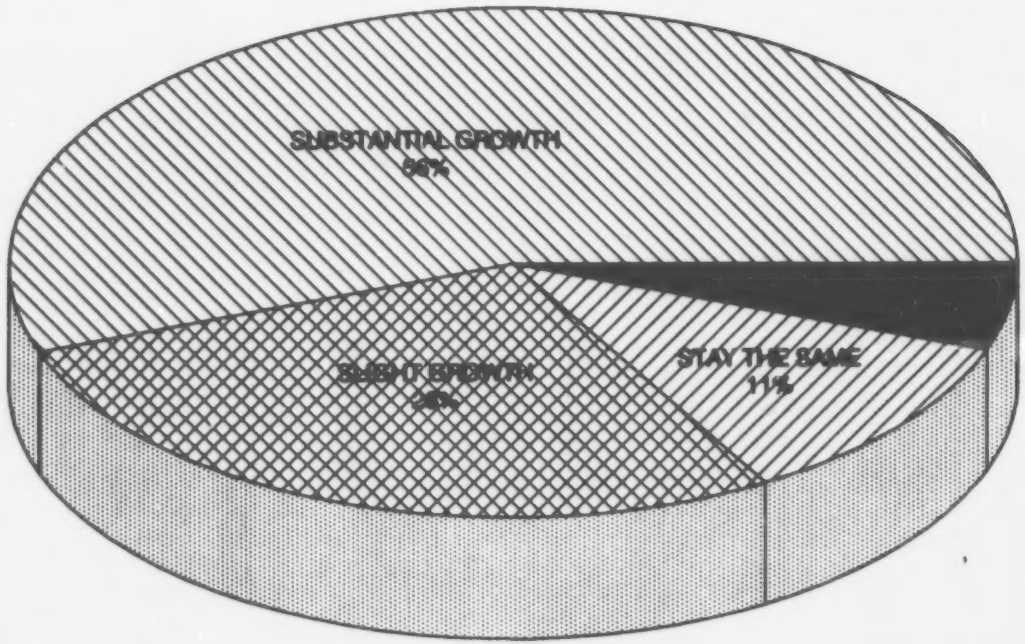



**Figure 5.13**
**SUMMARY OF OPINIONS ON FUTURE CHANGES IN SIZE OF RECYCLING BUSINESSES**

| Table 5.18<br>SUMMARY OF PRICE INFORMATION FROM AGENTS SURVEYED | | | |
|---|---|---|---|
| Material | Number of Companies Reporting Price >$0/tonne | Reported Range in Price ($/tonne) | Mean Reported Price ($/tonne) |
| Aluminum | 4 | 28 - 360 | 158 |
| Corrugated Cardboard | 5 | 28 - 217 | 94 |
| Drywall | 2 | 110 - 217 | 164 |
| Fine/Office Paper | 5 | 25 - 110 | 55 |
| Glass | 2 | - | 28 |
| Newspaper | 3 | 28 - 83 | 46 |
| Plastic | 4 | 28 - 550 | 258 |
| Rubber Tires | 1 | - | 110 |
| Tinplate Steel | 2 | 28 - 110 | 69 |
| Wood Waste | 1 | - | 30 |
| Liquid Waste | 1 | - | 400 |
| Miscellaneous Metals | 1 | - | 4 |
| Other | 2 | 55 - 217 | 136 |

1) Substantial increase
2) Slight increase
3) No change
4) Slight decrease
5) Substantial decrease

Figure 5.14 again uses a pie chart to summarize the percentage breakdown of responses. It would appear that business is well aware of the impacts of new regulatory initiatives on their costs. Approximately one-quarter expect a substantial increase in costs, while an additional one-third anticipate slight increases. By the same token, however, it would appear that opinions regarding growth indicate that the industry believes that increases in costs can be overcome.

The responses to these two questions indicate a generally positive attitude toward opportunities for growth in the private sector recycling business. Appropriate policy initiatives will serve to foster and promote these attitudes, and enhance business activities.

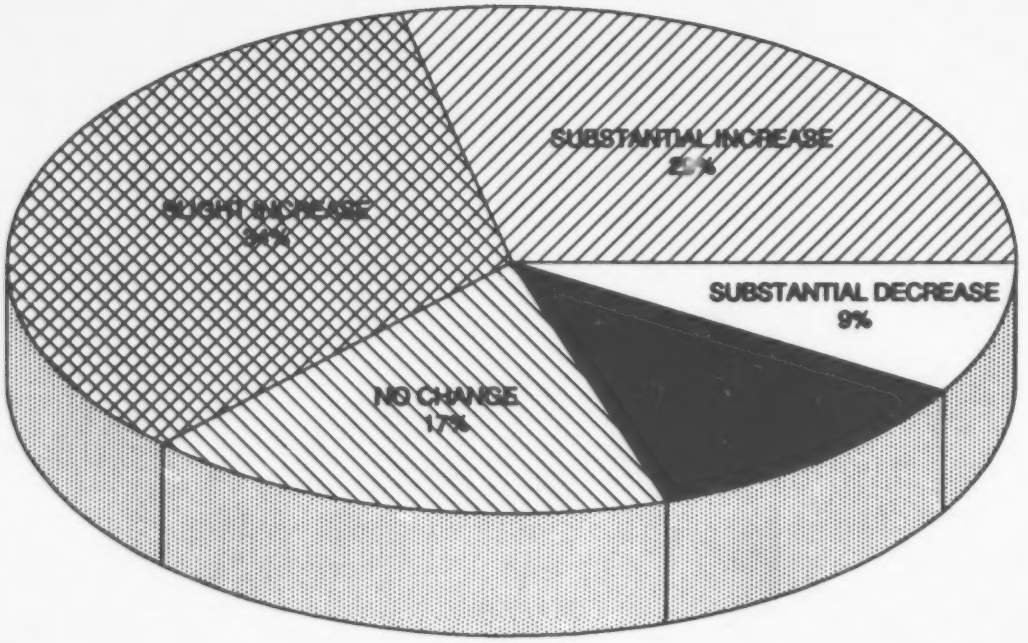



**Figure 5.14**
**SUMMARY OF OPINIONS ON CHANGES IN THE COSTS OF THE RECYCLING BUSINESS**

# Section 6
# EXECUTIVE SUMMARY

## 6.1 BACKGROUND

In January 1990, the MOE Policy and Planning Branch awarded a contract to CH2M HILL ENGINEERING LTD. (with MacLaren Engineers as subcontractors) to develop a database on the Physical and Economic Dimensions of the Municipal Solid Waste Management System in Ontario. The study was carried out concurrently with three other studies to assess the socio-economic impacts of the waste diversion objectives announced on March 10, 1989. The objectives stated that 25% of the waste stream was to be diverted from landfill and incineration by 1992, and 50% was to be diverted by the year 2000. A base year 1987 (adjusted for population growth) has been used for all of these objectives. The three other studies carried out concurrently, and the consultants awarded the contracts for these studies are as follows:

- Market Assessment of 3Rs Activities in Ontario (RIS & VHB)
- True Costs of Waste Management (VHB & MacLaren)
- Co-ordination and Synthesis (VHB & Econometric Research Ltd.)

## 6.2 OBJECTIVE

The basic objective of this study (referred to as the MSW study) was to provide a working snapshot of the current waste management system in Ontario.

## 6.3 METHOD

The waste management system was divided into two major components for the study, namely:

- waste generation (i.e. quantities of waste produced by various sectors)
- waste disposal

As much information as possible was obtained on waste generation for different counties and municipalities in Ontario through a review of all available Waste Management Master Plans.

Residential waste composition was estimated by combining information from a number of sources, including the recently completed study by Gore and Storrie. Industrial/commercial/institutional waste composition and generation rate information was obtained from a number of waste audits carried out in the province. This information was divided into 25 ICI categories. The composition and quantities of ICI waste produced

by each county in Ontario was estimated using employment data for the county. The estimates were corrected using actual data, where available. This exercise resulted in an estimate of the quantity and type of each waste produced in the province.

Information on landfills in the province was obtained from Waste Management Master Plans, the MOE Site Summary Reports, the MOE Inventory of Open and Operating Landfills, and a survey of 420 landfills carried out by MacLarens/VHB as part of a concurrent study.

Information on the three MSW incinerators in operation in Ontario was obtained through telephone conversations with the operators. Information on transfer stations was obtained in Waste Management Master Plans, and was confirmed by follow-up phone calls.

Information on haulers was obtained through an industry survey carried out by Dun and Bradstreet as part of this study. Information on the hauling and recycling industries was purchased from Dun and Bradstreet.

Information on recycling programs, expenditure on recycling, and the quantities of material recycled was obtained from the MOE Waste Management Branch, OMMRI and the COBIS Report. Information on Material Recycling Facilities (MRFs) was obtained through a survey carried out by MacLarens/VHB during a concurrent study.

## 6.4 SCOPE

The scope of the study was limited to municipal solid waste (MSW), i.e. non-hazardous material which is currently disposed at municipal landfills and incinerators. It also included material which is currently collected from the residential sector and recycled.

## 6.5 SUMMARY OF FINDINGS

### 6.5.1 Waste Generation

1. The Ontario Residential Sector generated an estimated 3,901,900 tonnes of waste in 1987, and an estimated 4,053,200 tonnes in 1989. This equates to a generation rate of approximately 420 kg/capita/year for both years.

2. The major components of residential waste are paper (36%), organics (32%), glass (7%), plastic (6%) and tinplate steel (6%).

3. Of these general categories, specific categories, which contribute significantly to the waste stream are newsprint (16.7%), food waste (15.5%) and yard waste (16.2%).

4. An estimated 2.5% of the residential waste stream was recycled in 1987. This increased to 5.1% in 1989.

5. An estimated 5,189,000 tonnes of waste was generated by the industrial/commercial/institutional (ICI) sector in 1987, and an estimated 5,361,000 tonnes was generated in 1989. This equates to an average generation rate of 560 kg/capita/year in 1987, and 559 kg/capita/year in 1989.

6. The major waste types generated by the ICI sector include: OCC, wood, paper, organics and metal.

7. The major generators of MSW in the ICI sector include the construction industry (an estimated 1.6 million tonnes in 1989), the communications and service sector (an estimated 1.3 million tonnes in 1989), wholesale and retail trade (an estimated 550,000 tonnes in 1989), transportation industries (an estimated 380,000 tonnes in 1989) and the food and beverage industry (an estimated 340,000 tonnes in 1989).

8. Complete data are not available on the percentage of MSW recycled by the ICI sector. Information obtained by RIS in a concurrent study indicate that a minimum 279,760 tonnes of waste was recycled by the ICI sector in 1989. This equates to 5.2% of the ICI waste stream.

9. Traditionally, comprehensive records of waste disposal at landfills and incinerators have not been maintained, hence reliable waste generation information is not available for many locations in the province.

10. In the past, very little information was collected on the composition of MSW. This has changed in the last year or two, with the landfill crisis in Southern Ontario, and the need to divert more materials from landfill. Many Ontario municipalities are now embarking on waste audit and waste composition studies to better define the components of the waste stream.

### 6.5.2 Waste Disposal

1. Landfilling is the method of disposal for most of Ontario's MSW. Less than 2% of Ontario's MSW is incinerated. An estimated 1% of Ontario's MSW was recycled through residential recycling programs in 1987. This figure increased to 2% in 1989. At least a further 3% of the total waste stream is recycled by the Ontario ICI sector. This figure may be higher but data are not available to substantiate this assumption at this time.

2. Ontario has over 1,400 landfills. Of these, 630 (45%) serve communities with populations less than 1,500, and another 350 (25%) are operated by Ministry of Natural Resources.

3. An estimated 40% of Ontario's annual landfill capacity will be lost in the next 1 - 3 years. Approximately 17% of Ontario's landfill capacity will be lost in 1991 with the projected closure of two of the province's largest landfills, Britannia Road (750,000 tonnes/year) and Brock West (964,000 tonnes/year). An additional 23% of Ontario's landfill capacity will be lost in 1993, with the projected closure of the Province's largest landfill, Keele Valley (2,250,000 tonnes/year).

4. Of the province's remaining landfills, an additional 95 are expected to reach capacity in 1991-1993. An estimated 145 will reach capacity between 1994 and 2003, and 10 will extend beyond the year 2004.

5. Landfill tipping fees vary through the province, from zero at some landfills to $150/tonne in the Metro Toronto area. In some cases, tipping fees have increased dramatically in the last few years. Metro Toronto area tipping fees have increased as follows: $18 (1987), $50 (1988), $85 (1989), $97 (1990), and $150 (1991). Increased tipping fees have encouraged 3Rs, which can now be justified on an economic basis.

6. Some smaller communities are reluctant to raise tipping fees, because of a concern about illegal dumping of waste.

7. Ontario has three incinerators which accept MSW. These are: SWARU Hamilton, and 3M and Victoria Hospital in London. Their combined capacity is 177,000 tonnes per year.

8. Sixty five hauling companies were surveyed as part of this study, and reported employment of 792. An additional 145 haulage companies who were not surveyed employ an estimated 1,977. However, some of these firms may be involved in other activities in addition to hauling. Total reported sales for haulers (both surveyed, and not surveyed) were $102,856,000. If it is assumed that large companies generally report sales figures, then this value should capture most of the haulage industry. The majority of respondents to the study survey anticipate a favourable business climate in the future.

### 6.5.3 Waste Recycling

1. Residential waste recycling programs have increase dramatically in the last few years. In 1987, 400,000 households were served by the Blue Box Program. This number had increased to 1.8 million households by 1989.

2. An estimated 97,000 tonnes of waste generated by the residential sector was recycled in 1987, and an estimated 206,400 tonnes was recycled in 1989. This translates to recycling rates of 2.5% and 5.1% of the residential waste stream for 1987 and 1989 respectively.

3. An estimated $10 million was expended by municipalities on residential waste recycling in 1987. This increased to an estimated $30 million 1988 and $42.5 million in 1989.

4. Because the available 1987 data were not broken down into capital and operating costs, direct comparison of 1987 and 1989 costs is not possible. However, the data show an estimated operating cost of $124.83 per tonne of residential waste recycled in 1989.

5. The prices paid for recycled material have varied over the last three years, and with the exception of aluminum have generally decreased. The reported 1990 prices were $7 - 12/tonne for newspaper. This price was low because of a labour dispute at the only Ontario de-inking mill. Prices for other recycled materials were $60/tonne for sorted glass, $70/tonne for loose steel, $90/tonne for densified steel, $1,400 - 2,000/tonne for baled aluminum, $300/tonne for baled PET, and $125/tonne for unbaled PET.

6. Aluminum is clearly the most valuable material recycled by the Blue Box Program. However, it currently accounts for less than 0.5% of the residential waste stream.

7. In 1987, 88 municipalities were served by 98 active recycling programs. There were 52 active recycling agents employing 287 full- or part-time staff, 10 of whom were physically or mentally challenged, and 207 volunteer workers.

8. Ontario employment related to the recycling industry is estimated at 3,400. Annual sales volumes are reported at $590 million. Approximately 30% of the companies in US SIC5093 (Wholesale of Scrap and Waste Materials) have started business in the 1980-1989 period. In general, most of the companies surveyed as part of this study expected an increase in business resulting from recycling initiatives.

9. There are 31 Material Recovery Facilities (MRFs) in the province, most of which are located in Southern Ontario. These are operated by either the municipality, the private sector or the third sector (non-profit interest organizations). Fourteen of these employ 308 full-time and 17 part-time staff.

10. Anticipated trends in 3Rs include a greater focus on composting of organic wastes. These account for an estimated 32% of the residential MSW stream. Composting is currently being encouraged on two fronts, either by offering individual composters to households, or by curbside collection of kitchen and yard wastes, which are then processed in a centralized composting facility.

11. Bans on accepting materials such as drywall, OCC, wood wastes, white goods, etc. at landfills are expected to stimulate increased 3Rs of these waste streams.

12. Municipalities are being encouraged to expand the Blue Box Program beyond the traditional four materials (newspaper, glass, metal and PET). Some municipalities have included corrugated cardboard, phone books and household hazardous waste in their programs. Others are experimenting with including film plastic, boxboard, magazines and fine paper in their programs.

13. The available data indicate that a minimum of 279,760 tonnes of waste, or 5.2% of the ICI waste stream was recycled in 1989. It is suspected that the actual quantity may be higher than this value, however no reliable data are available to substantiate this option. More research should be carried out in this area.

# APPENDIX A

## References

# Appendix A
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# APPENDIX B

## Dun & Bradstreet Survey

WASTE MATERIALS
#5323/90

DUN & BRADSTREET CANADA
5770 HURONTARIO STREET
MISSISSAUGA, ONTARIO
L5R 3G5
(416) 568-6162

*ASK TO SPEAK TO THE PRESIDENT OR CONTROLLER*

Good_____it's_____calling from Dun & Bradstreet.
We are conducting a survey about solid waste removal and processing of recyclable materials in the Province of Ontario.

1a) First of all, which of the following types of business does your company conduct in Ontario?
(READ LIST, CIRCLE AS MANY AS APPLY)

%

| | |
|---|---|
| HAULING of non-hazardous, solid waste or recyclable.materials 1 | \|_\|_\|_\| |
| PROCESSING of recyclable materials..... 2 | \|_\|_\|_\| |
| OR Some other activity(WRITE IN)_____ | \|_\|_\|_\| |
| _____ | \|_\|_\|_\| |
| _____ | \|_\|_\|_\| |
| TOTAL 100% | |

*FOR EACH CATEGORY MENTIONED IN QU.1a), ASK QU.1b).*

1b) And in Ontario, what percentage of your business is.....(READ CATEGORY)
READ CATEGORY CITED AND ASSIGN PERCENTAGE. ENSURE AMOUNT TOTALS 100%

*IF 100% IN OTHER, TERMINATE AND RECORD*

2) What percentage of your total business is conducted in the Province of Ontario (WRITE IN PERCENTAGE)

\|_\|_\|_\| %

3) Just thinking of your operations in Ontario, what is your company's total annual operating costs? (WRITE IN)

$_____

4) In the future, as more waste reduction, reuse of materials, and recycling programs are implemented, how do you see the GROWTH OF YOUR BUSINESS. Do you think your business will have...(READ LIST, CIRCLE ONE ONLY).

Substantial Growth.....1

Slight Growth.....2

Stay the same.....3

Slight loss of Business.....4

OR Substantial Loss of Business.....5

5) In the future, as more waste reduction, reuse of materials, and recycling programs are implemented, how do you see your COMPANY'S COSTS CHANGING. Do you think your business will have.....(READ LIST, CIRCLE ONE ONLY)

Substantial Increase.....1

Slight Increase.....2

No change.....3

Slight decrease.....4

OR Substantial decrease.....5

**IF MORE THAN 1% IN SOLID WASTE REMOVAL,IN QU.1a,ASK SECTION I.
IF 0% IN SOLID WASTE REMOVAL ASK SECTION II.**

SECTION 1 (SOLID WASTE REMOVAL/HAULING)

6) Annually, what is the total amount of garbage, in metric tonnes, that your company HAULS AND DISPOSES of at landfills, incinerators, and transfer stations in Ontario? (WRITE IN TOTAL)

_____ tonnes

7) Annually, what is the total amount of recyclable materials, in metric tonnes that your company HAULS in Ontario? (WRITE IN TOTAL)

_____ tonnes

8) Which Ontario municipalities does your company haul solid waste for?
(DO NOT READ, CIRCLE AS MANY AS APPLY).

AJAX.....1
BARRIE.....2
BELLEVILLE.....3
BRAMPTON.....4
BRANTFORD.....5
BURLINGTON.....6
CALEDON.....7
CAMBRIDGE.....8
CHATHAM.....9
CORNWALL.....10
CUMBERLAND TWP.....11
EAST YORK.....12
ETOBICOKE.....13
GLOUCESTER.....14
GUELPH.....15
HALTON HILLS.....16
HAMILTON.....17
KANATA.....18
KINGSTON.....19
KINGSTON TWP.....20
KITCHENER.....21
LONDON.....22
MARKHAM.....23
MILTON.....24
MISSISSAUGA.....25
NEPEAN.....26
NEWCASTLE.....27
NEWMARKET.....28
NIAGARA FALLS.....29
NORTH BAY.....30
NORTH YORK.....31
OAKVILLE.....32
OSHAWA.....33
OTTAWA.....34
PETERBOROUGH.....35
PICKERING.....36
RICHMOND HILL.....37
SARNIA.....38
SAULT STE.MARIE.....39
SCARBOROUGH.....40
ST.CATHARINES.....41
STONEY CREEK.....42
SUDBURY.....43
TIMMINS.....44
TORONTO.....45
THUNDER BAY.....46
VAUGHAN.....47
WATERLOO.....48
WINDSOR.....49
WELLAND.....50
WHITBY.....51
YORK.....52
OTHER_____

_____

_____

9a) What percentage of solid waste HAULED by your company in Ontario is from the following sources? (READ TYPE, AND ENTER PERCENTAGE).

| | QU.9a % | Qu.9b $/t |
|---|---|---|
| COMMERCIAL | ___ | $_____ |
| INDUSTRIAL | ___ | $_____ |
| RESIDENTIAL | ___ | $_____ |
| OR ANY OTHER TYPE (WRITE IN) | | |
| _____ | ___ | $_____ |
| _____ | ___ | $_____ |
| MUST TOTAL | 100% | |

*FOR EACH TYPE MENTIONED IN QU.9a ASK QU.9b*

9b) And, what price per metric tonne does your company charge to haul....(type of waste in Qu.9a)? (ENTER PRICE BESIDE TYPE MENTIONED)

10) What percentage of recyclable materials HAULED by your company in Ontario is from the following sources? (READ SOURCE AND ENTER PERCENTAGE. ENSURE TOTAL IS 100%)

| | % |
|---|---|
| COMMERCIAL | ___ |
| INDUSTRIAL | ___ |
| RESIDENTIAL | ___ |
| OTHER (WRITE IN)_____ | ___ |
| _____ | ___ |
| | 100% |

11a) I am going to read you a list of typical trucks used in the hauling of solid waste materials. I would like you to tell me the size or capacity of truck that your company uses for the hauling of solid waste. The first truck is.....(READ LIST). What other sizes?.....(ENTER SIZE OR CAPACITY VERBATIM).

| | QU.11a SIZE/CPY | QU.11b NUMBER |
|---|---|---|
| CLOSED BODY COMPARTMENTALIZED HYDRAULIC TOP-LOADING. | _____ | _____ |
| CLOSED BODY COMPARTMENTALIZED OPEN SIDED | _____ | _____ |
| PACKER TRUCK FRONT LOADING | _____ | _____ |
| PACKER TRUCK REAR LOADING | _____ | _____ |
| PACKER TRUCK SIDE LOADING | _____ | _____ |
| OR ANY OTHER TYPE (WRITE IN) | | |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| | _____ | _____ |
| | _____ | _____ |

*FOR EACH TYPE OF TRUCK MENTIONED IN QU.11a, ASK QU.11b)*

11b) And how many (TYPES OF TRUCK) trucks does your company use to haul solid waste in Ontario (ENTER NUMBER BESIDE TYPE MENTIONED IN QU.11a)

*IF 0% IN RECYCLABLE MATERIALS IN QU.1b TERMINATE AND RECORD*

## SECTION 11 - PROCESSING OF RECYCLABLE MATERIALS

12) Annually, how many metric tonnes of recyclable materials does your company process in Ontario? (WRITE IN)

_____ t

13) What percentage of recyclable materials PROCESSED by your company in Ontario is from the following sources? (READ LIST, ENTER PERCENTAGE)

| | % |
|---|---|
| COMMERCIAL | \|_\|_\|_\| |
| INDUSTRIAL | \|_\|_\|_\| |
| RESIDENTIAL | \|_\|_\|_\| |
| OTHER (WRITE IN)_____ | \|_\|_\|_\| |
| _____ | \|_\|_\|_\| |
| MUST TOTAL | 100% |

14a) What percentage of the recyclable materials PROCESSED by your company in Ontario are of the following type? (READ LIST, ENTER PERCENTAGE)

| | QU.14a % | QU.14b $/mt |
|---|---|---|
| ALUMINUM | \|_\|_\|_\| | $_____ |
| CORRUGATED CARDBOARD | \|_\|_\|_\| | $_____ |
| DRYWALL | \|_\|_\|_\| | $_____ |
| FINE/OFFICE PAPER | \|_\|_\|_\| | $_____ |
| GLASS | \|_\|_\|_\| | $_____ |
| NEWSPAPER | \|_\|_\|_\| | $_____ |
| PLASTIC | \|_\|_\|_\| | $_____ |
| RUBBER TIRES | \|_\|_\|_\| | $_____ |
| TINPLATE STEEL | \|_\|_\|_\| | $_____ |
| WOOD WASTE | \|_\|_\|_\| | $_____ |
| OR ANY OTHER TYPES(WRITE IN) | | $_____ |
| _____ | \|_\|_\|_\| | $_____ |
| _____ | \|_\|_\|_\| | $_____ |

*FOR EACH TYPE MENTIONED IN QU.14a ASK QU 14b)*

14b) And what price does your company charge per metric tonne for PROCESSING of..... (READ TYPE MENTIONED IN QU.14a)? (ENTER PRICE BESIDE TYPE)

15) Which Ontario municipalities does your company process recyclable materials for?
(DO NOT READ, CIRCLE AS MANY AS APPLY).

AJAX.....1
BARRIE.....2
BELLEVILLE.....3
BRAMPTON.....4
BRANTFORD.....5
BURLINGTON.....6
CALEDON.....7
CAMBRIDGE.....8
CHATHAM.....9
CORNWALL.....10
CUMBERLAND TWP.....11
EAST YORK.....12
ETOBICOKE.....13
GLOUCESTER.....14
GUELPH.....15
HALTON HILLS.....16
HAMILTON.....17
KANATA.....18
KINGSTON.....19
KINGSTON TWP.....20
KITCHENER.....21
LONDON.....22
MARKHAM.....23
MILTON.....24
MISSISSAUGA.....25
NEPEAN.....26
NEWCASTLE.....27
NEWMARKET.....28
NIAGARA FALLS.....29
NORTH BAY.....30
NORTH YORK.....31
OAKVILLE.....32
OSHAWA.....33
OTTAWA.....34
PETERBOROUGH.....35
PICKERING.....36
RICHMOND HILL.....37
SARNIA.....38
SAULT STE.MARIE.....39
SCARBOROUGH.....40
ST.CATHARINES.....41
STONEY CREEK.....42
SUDBURY.....43
TIMMINS.....44
TORONTO.....45
THUNDER BAY.....46
VAUGHAN.....47
WATERLOO.....48
WINDSOR.....49
WELLAND.....50
WHITBY.....51
YORK.....52
OTHER_____

_____

_____

16a) Currently, how many of the following types of recycling equipment are currently in use by your company in Ontario? (READ LIST AND ENTER NUMBER FOR EACH TYPE MENTIONED).

| | NUMBER | MANUFACTURED IN ONTARIO | |
|---|---|---|---|
| | | YES | NO |
| AIR CLASSIFIERS | _____ | 1 | 2 |
| BALERS | _____ | 1 | 2 |
| CONVEYORS | _____ | 1 | 2 |
| GLASS CRUSHERS | _____ | 1 | 2 |
| PAPER SHREDDERS | _____ | 1 | 2 |
| MAGNETIC SEPARATORS | _____ | 1 | 2 |
| METAL DENSIFIERS | _____ | 1 | 2 |
| METAL FLATTENERS | _____ | 1 | 2 |
| PLASTIC GRANULATORS | _____ | 1 | 2 |
| OTHER (WRITE IN) _____ | _____ | 1 | 2 |
| _____ | _____ | 1 | 2 |
| _____ | _____ | 1 | 2 |

*FOR EACH TYPE MENTIONED IN QU.16a, ASK QU.16b*

16b) And was the (READ TYPE OF MACHINERY) manufactured in Ontario? (CIRCLE EITHER YES OR NO)

17) Finally I'd just like to confirm your name and title as well as the company's address and phone number. (RECORD RESPONDENT'S NAME AND TITLE. RECORD COMPANY NAME AND ADDRESS FROM DMI).

CONTACT NAME_____

CONTACT TITLE_____

COMPANY NAME_____

COMPANY ADDRESS_____

_____

COMPANY PHONE_____

THANK YOU FOR YOUR TIME AND HELP!!!

INTERVIEWER |_|_| DATE |_|_|_|_|
D D M M

QUALITY CHECKED BY:_____ DATE |_|_|_|_|
D D M M

# APPENDIX C

## Recycling Funding

# Appendix C
# DESCRIPTION OF FUNDING PROGRAMS FOR RECYCLING ACTIVITIES

## OMMRI Financial Support

The Ontario Multi-Material Recycling Inc.(OMMRI) was created in 1986 by the soft drink industry and its container suppliers to ensure compliance with Ontario soft drink container recycling regulations. Throughout recent years, the OMMRI mandate has been to encourage the development of multi-material recycling throughout Ontario with emphasis on recycling soft drink containers. Since its conception, OMMRI has expanded to include other food and container representatives: The Ontario Printing Paper Users Group, Canadian Council of Grocery Distributors, Grocery Products Manufacturers of Canada, Society of Plastics Industry of Canada and the Packaging Association of Canada. The expanded group works under the revised title - OMMRI: Corporations in Support of Recycling (OMMRI II).

OMMRI (and OMMRI II) contributes to the establishment of municipal recycling programs by funding up to one-third for the start up costs of Blue Boxes, recycling trucks and processing centres.

## MOE Municipal Recycling Support Program (MRSP)

Along with OMMRI, the Ministry of the Environment offer to reimburse one-third of the capital costs incurred by the municipality for the curbside collection program. However, only the MRSP offers to share the operating costs by paying, in the first year, up to 50% of the operating costs incurred by the municipality and then, up to 40%, 30%, 20% and 10% for each subsequent year.

Although the MRSP programs is geared towards the development of multi-material curbside collection programs, grants have been set aside under the auspices of the MRSP to facilitate program expansion. Other grants include:

- Household Bins - Recognizing the high upfront expenditures associated with Blue Box programs, the MOE provides grants for up to one-third of the cost of the collection bins.

- Promotion and Advertising - An integral component of any multi-material recycling program is the establishments of an aggressive and informative advertising program. Depending on the size and density of the targeted population, a variety of activities are available to promote the recycling program. With this in mind, the MOE offers two payment options to the municipalities - up to 50% of the costs or a maximum of $0.10/capita/year for five years.

- Demonstration Project - Grants of up to 100% of the cost of the demonstration project is available for innovative, experimental recycling projects. The project emphasizes research and data collection activities. Due to the originality of the project, a wide range of programs have received funding to date including: Cobourg's user pay system approach, Durham's program to promote fine paper recycling in the corporation and commercial sectors, and Peterborough's project to incorporate plastic film in the Blue Box program.

- Education Project - Grants of up to $15,000 are available for municipalities wanting to implement educational programs aimed at increasing awareness and understanding of, and participation in 3R activities.

- Feasibility - Initial program development requires an assessment of costs, equipment and facility needs. The MOE helps municipalities with the costs of a feasibility study by providing funds up to 50% of the cost.

**MNDM Municipal Recycling Support Program**

The Ministry of Northern Development and Mines (MNDM) has instituted a joint program with the MOE to provide additional capital assistance to help northern municipalities begin recycling in their communities. The MOE will administer the funds as part of their MRSP although, along with MNDM, it recognizes the need to remain flexible with funding, particularly with smaller municipalities, where per capita costs may be unavoidably high. This additional funding is provided for a number of specific areas using the following formula:

- Collection and Processing Equipment - MOE 1/3, OMMRI 1/3, MNDM 1/6, Municipality 1/6;

- Collection Bins - MOE 1/3, OMMRI 1/3, MNDM 1/6, Municipality 1/6;

- Building Construction - MOE 1/3, MNDM 1/3, Municipality 1/3.

**MOE - Municipal Recovery Program**

The Ministry of the Environment initiated the Municipal Recovery Program in June 1987 to encourage municipalities to set up recovery programs for wastes disposed in landfills. The program provides capital grants for processing facilities to recover traditional curbside recyclable materials (newspaper, glass, metal, plastic) as well as other materials from mixed (unsorted) solid waste (compost, paper). Large scale municipal composting of organics and material processing plants would be eligible for these grants. The program funds up to one third of the in-service capital costs (feasibility studies, design, approval construction, and commissioning) and up to 100% of the costs of research, development and demonstration projects. Municipalities must submit the proposal and in the case of private sector contracts, the proposal may be submitted from the municipality concerned.

**MOE- Municipal Reduction/Reuse Program**

This program, initiated in 1987, is intended to encourage greater awareness of buying habits and products that can reduce waste production rates. This program completes the agenda for MOE funding programs aimed at diverting waste from landfill through 3R (reduce, reuse, recycle) initiatives. Assistance is available for projects to alter consumer waste generating behaviour such as home composting and package substitution. Municipalities, private sector organizations and individuals are eligible for up to 50% of capital and promotional costs as well as up to 100% of creative educational projects to a limit of $25,000 per project. As with the other funding programs, the MOE evaluates the application according to the scope of the project and the potential to impact on the quantity and quality of the municipal waste stream.

**FAP - MOE Comprehensive Funding Program**

The Financial Assistance Program (FAP) covered under the MOE comprehensive funding program, provides funds to assist municipalities develop new landfill sites, transfer stations and processing facilities and to expand existing facilities. Eligible activities range from initial facility design to capital costs of construction. The amount and duration of funding through FAP depends on the number of people served by the facility. Municipalities and Counties are eligible for up to 60% of the total costs of the facility.

**Student Action For Recycling (STAR)**

Student Action for Recycling (STAR) was initiated in October 1988 to facilitate increased student awareness of and participation in waste minimization activities. The STAR program promotes the introduction of multi-material recycling into the schools. School boards may apply for assistance on behalf of the school for two-thirds the

capital cost associated with collection and storage and half of the co-ordinator's salary for the first year.

## Table C.1 MINISTRY OF THE ENVIRONMENT - 3'Rs FUNDING PROGRAMS

| Program | Program brief | Grant Information* | | | |
|---|---|---|---|---|---|
| | | Type | Eligibility: Municipal | Eligibility: Private sector | Details |
| Municipal Recycling Support Program | Provides assistance to municipalities and others in the development and management of local recycling initiatives that will reduce waste disposal requirements and provide other environmental benefits to Ontario. | • Operating cost grant | ✓ | ✓ (non profit) | - up to 5 yrs. (50%-1st year, 40, 30, 20, 10%-5th year) |
| | | • Capital cost grant | ✓ | ✓ (non profit) | - 1/3 (land, land improvements, and existing assets not eligible) |
| | | • Household bins | ✓ | ✓ (non profit) | - 1/3 (maximum replacement @ 2%/yr. over 5 yrs.) |
| | | • Promotion & advertising | ✓ | ✓ (non profit) | - up to 50 % or $0.10/capita/year max. over 5 yrs. |
| | | • Education Grant | ✓ | ✓ | - case-by-case, up to $ 15,000 |
| | | • Demonstration grant | ✓ | ✓ | - up to 100 % of the cost to advance state-of-the-art technology through pilot programs |
| | | • Feasibility Study | ✓ | ✓ (non profit) | - up to 50 % of the cost required to plan and analyse recycling projects |
| Municipal Reduction Reuse Program | Encourage greater awareness of buying habits and products that will reduce waste production rates. Assistance may be obtained for projects to alter consumer waste generating behavior, such as, home composting, packaging, new product approaches. Private sector and individuals are eligible for projects aimed at reduction or reuse of waste materials that would otherwise be directed to municipal landfill. (before the material enters the waste stream) | • Capital cost grant | ✓ | | - up to 50 % |
| | | • Promotion & advertising | ✓ | ✓ | - up to 50 % |
| | | • Creative projects | ✓ | | - up to 100 % of creative/innovative materials or projects (max. $25,000) |
| Municipal Recovery Program | To recover materials from the waste stream. Assistance may be obtained for projects to establish facilities to recover or process paper, refuse derived fuel, compost, aluminum, steel, glass, plastic or other materials. | • Demonstration grant | ✓ | | - up to 100% of costs for period necessary to demonstrate the project |
| | | • Capital grant | ✓ | | - up to 1/3 for feasibility, design, approval, construction and commissioning |
| STudent Action for Recycling | To increase students awareness of waste management, through direct action, by introducing recycling into educational institutions. The Student Action for Recycling program is intended to be operated in conjunction with the local municipal recycling system. School boards may apply for assistance on behalf of schools in their jurisdiction | • Capital grant | ✓ (Applicants should be School Boards only. However, at the request of the Board, municipalities may apply for 100% funding for a collection vehicle(s) dedicated to servicing the Board) | | - 2/3 of capital costs for collection, storage, construction and safety equipment.<br>- 1/2 of co-ordinators salary for 1st year ($20,000 max.) |

Sources: MOE, 1990

# APPENDIX D

## The Municipal Solid Waste Database

# Appendix D
# THE MUNICIPAL SOLID WASTE DATABASE

## D.1 GENERAL

The purpose of this appendix is to describe in greater detail the structure and use of the database created as part of this study. The following issues need to be addressed:

- General information regarding the capabilities and use of dBASE IV.
- Description of each file constituting the database, including the following:
  - source of information and its completeness
  - nature of data (i.e., character or logical information, estimated or actual quantities, etc.)
  - coding of information in the file and how each file may be connected to others in the database
  - assumptions and limitations of the data
- Updating of information in the database.

## D.2 GENERAL INFORMATION ON dBASE IV

In order to assist those who are unfamiliar with dBASE IV, this section provides a brief summary of some of its capabilities and uses.

In dBASE IV, raw data are stored in files with a **.DBF** extension to the filename.

**Example:** All raw data on residential generation rates for each municipality in the province is stored in the file **RESIDENT.DBF**.

Each .DBF file may be thought of as a large table, where rows are referred to as *records* and columns are referred to as *fields*. Column headings are referred to as *field names*.

**Example:** The file LANDFILL.DBF provides information on 730 landfills. Thus the file contains 730 records. Up to 50 different pieces of information are available on each landfill. Thus the file contains 50 fields for each record.

The description of the structure of each database, as presented at the end of this Appendix provides information on the records and fields of all database files.

**Example:** Referring to the appropriate structure description at the end of this Appendix, the file RECYCLE.DBF contains 46 records and 24 fields. The field "CTY" contains numerical information and is 5 digits wide. This field contains the 5 digit code which identifies the county for each record. The field "CONTACT" contains character information and is 30 characters wide. This field provides the name of a municipal official who can be contacted regarding recycling for that municipality. The field "BBOXPROG" contains logical information and is 1 character wide. This field provides yes/no or true/false information on the existence of Blue Box programs for each municipality.

Information in database files may be coded to reduce the amount of memory required to store the information, to avoid problems such as inconsistent spelling and abbreviations and, most importantly, to provide a link between files containing information on a common subject.

**Example:** Wherever possible throughout the database files, municipalities and counties have been given a unique five digit code. Thus it is possible to print all information related to a particular municipality from several different files, including:

- AGENT1.DBF
- CTYCODE.DBF
- ICICTY87.DBF
- ICICTY89.DBF
- LANDFILL.DBF
- MRF.DBF
- MUNCODE.DBF
- RECYCLE.DBF
- TRANSFER.DBF
- RESIDENT.DBF

Data in .DBF files are stored in the order in which they are entered. In order to sort the data in numerical or alphabetical order, the dBASE IV function *Queries* may be used. In addition, files containing common coded information may be linked and new *calculated fields* may be created through mathematical manipulation of existing fields. The use of calculated fields minimizes the amount of memory required to store the database files.

**Example:** The data contained in RESIDENT.DBF is identified by municipality and county numerical codes. In order to sort the data *alphabetically* by county and then by municipality, the Queries function may be used to *link* RESIDENT.DBF to MUNCODE.DBF and CTYCODE.DBF, where the names of municipalities and counties are stored as character fields. The *sort* is then also executed by the Queries function. Data on quantities of individual components of the waste stream, such as newsprint, may be generated by linking RESIDENT.DBF to files on waste stream composition (RESCOM87.DBF and RESCOM89.DBF) and creating *calculated fields* that multiply total amount by composition to give amount of each component.

Queries are also useful in printing *Reports*. Any given field of information may be included or excluded from the printed report, fields from different .DBF files and calculated fields may be printed on the same page through linking and printed reports may be sorted alphabetically or numerically. The Report function allows custom designing of what the printed page will look like. For example, different page sizes can be accommodated, depending on the printer in use, and margins, page breaks, column widths as well as other print functions can be selected. In addition, the Reports function provides for automatic subtotalling and totalling of numeric columns, among other arithmetic functions.

It is important to note that, for the most part, the preceding is a description of dBASE IV capabilities which are not peculiar to the MSW database. The purpose of selecting a widely available software package was to take advantage of built-in capabilities such as these. This is by no means a comprehensive description of dBASE IV's capabilities. However, it does point out some the most important functions that were used to advantage in developing the study database and in analyzing the available data.

## D.3 MUNICIPAL SOLID WASTE DATABASE FILES

### D.3.1 Quantity and Composition Files

**RESIDENT.DBF**

**Description**

- For each municipality, data for 1987 and 1989 populations and residential generation rates (per capita) and quantities are provided. Either generation rate or quantity may be updated if better data become available, however, both should be changed in that instance. This can be accomplished through the population data provided. In other words, if generation rate data are changed, total quantities should be recalculated by

multiplying by population, and vice versa. This may be accomplished through dBASE IV commands rather than by long-hand calculations.

**Source**

- Residential generation rates are taken from WMMPs, where available.
- Population figures are taken from *Demographic Bulletin* published by the Ministry of Treasury and Economics (July, 1989).

**Assumptions**

- Generation rates have been assumed for those records where no data are available. In these cases, the field ASSUMRES is assigned the value "yes". Such entries are made for less than half of the province's population. The assumed values chosen are those required to yield the provincial totals presented in Table 3.4 of this report. Further discussion may be found in Section 3.2.3.

**Coding**

- Each record contains five digit codes to identify both municipality and county. This allows linking to a number of other files as listed in Section D.2.
- Links to files on waste composition are also provided.

**ICICTY87.DBF AND ICICTY89.DBF**

**Description**

- ICI waste quantities by IMC and county for 1987 and 1989 as presented in Section 3.3.

**Source**

- These are the estimates based on employee generation rates and employment data as presented in Table 3.10, broken down by county. For discussion, see Section 3.3.4.

**Assumptions**

- See Section 3.3.4.

**Coding**

- Counties are identified by their five digit code. In three instances, quantities for more than one county are combined. Additional fields are provided for more than one county code.

**ICICPT87.DBF AND ICICPT89.DBF**

**Description**

- ICI waste quantities by IMC and component for 1987 and 1989 as presented in Section 3.3 of this report.

**Source**

- As for ICICTY87.DBF and ICICTY89.DBF.

**Assumptions**

- See Section 3.3.4.

**Coding**

- No coding of this information was possible.

**RECYCLE.DBF**

**Description**

- Residential recycled waste quantities by municipality and county as presented in Table 3.14.

**Source**

- See Section 3.4.

**Assumptions**

- See Section 3.4.

**Coding**

- County and municipality are identified by five digit code.
- Agent is identified by one or two digit code for linking with AGENT1.DBF.

**RESCOM87.DBF AND RESCOM89.DBF**

**Description**

- Data on residential waste composition for 1987 and 1989, as presented in Table 3.3.

**Source**

- See Section 3.2.

**Assumptions**

- See Section 3.2.

**Coding**

- These fields are coded to link with RESIDENT.DBF on the COMP87 and COMP89 fields. In this way, total quantities from RESIDENT.DBF may be multiplied by composition from RESCOM87.DBF or RESCOM89.DBF to produce quantities of individual waste components as presented in Table 3.4. As noted earlier, this may be accomplished through the creation of calculated fields in the Queries function.

## D.3.2 Waste Management Facilities Files

### LANDFILL.DBF

#### Description

- Information on 730 landfills, including site, location, operator, municipalities serviced, wastes accepted and amounts, remaining life and economic data.

#### Source

- MOE Site Summary Reports (SSRs) on landfills in southern Ontario.
- WMMPs provided some data to update SSRs.
- MOE Approvals Branch identified major landfills serving more than 1,500 people in the Northeastern Region.
- MOE Northwestern Regional office identified major landfills serving more than 1,000 people.
- VHB/MacLaren survey (received more than 200 responses from landfills identified in the SSRs).

#### Assumptions

- See Section 4.2.2.

#### Coding

- Municipalities serviced are identified by the five digit code, as well as county and site location.

### MRF.DBF

#### Description

- Information on 14 MRFs including location, contact, economic data, activities, materials handled and municipalities served.

**Source**

- VHB/MacLaren survey.

**Assumptions**

- See Section 5.3.2.

**Coding**

- Location and municipalities served are identified by five digit code.
- Agent operating the MRF is identified by one or two digit code for linking to AGENT1.DBF.

**TRANSFER.DBF**

**Description**

- Information on 29 transfer stations including location, operator, municipality served, and waste destination.

**Source**

- WMMPs.

**Coding**

- Location and municipalities served are identified by five digit code.

### D.3.3 Waste Pathways Files

**AGENT1.DBF**

**Description**

- Information on 80 recycling agents involved in municipal recycling programs, including municipalities served, contact names and economic data, see discussion in Section 5.4.2.

**Source**

- Recycling Council of Ontario, 1987. *Municipal Source Separation Programs in Ontario*.
- MOE Waste Management Branch.
- VHB/MacLaren survey of MRFs.

**Coding**

- Agent numbers provide links to RECYCLE.DBF and MRF.DBF.
- Municipalities served are identified by five digit code.

**AGENT2.DBF**

**Description**

- Information on 295 recycling agents including materials handled and function (dealer, broker, transport, disposal, etc.).
- See discussion in Section 5.4.2.

**Source**

- *Recoup's Canadian Recyclers Directory*, 1987

**Coding**

- None applicable.

**EQUIP.DBF**

**Description**

- Information on 44 equipment suppliers including address and type of equipment.

**Source**

- *OWMA Members Directory*, 1989.

**Coding**

- None applicable.

**HAULER.DBF**

**Description**

- Information on 123 haulers in Ontario, including type of waste handled, operation of landfills or transfer stations and involvement in recycling activities. Purported to account for 85% of the waste handled in Ontario.

**Source**

- *OWMA Members Directory*, 1989.

**Coding**

- None applicable.

**SIC5093.DBF**

**Description**

- Information on 285 waste material wholesalers including employment, sales figures and descriptions of type of business in words and by SIC.

**Source**

- *Dun & Bradstreet Canadian DMI System Tape Record.*

**Coding**

- None Applicable.

**SIC4953A.DBF**

**Description**

- Information on 230 haulers and recyclers (and other businesses grouped under "Refuse Systems") including employment, sales figures and descriptions of type of business in words and by SIC.

**Source**

- *Dun & Bradstreet Canadian DMI System Tape Record.*

**Coding**

- None Applicable.

**SIC4953B.DBF**

**Description**

- Information on 65 haulers and recyclers (and other businesses grouped under "Refuse Systems") including employment, sales figures, descriptions of type of business in words and by SIC and telephone survey responses.

**Source**

- *Dun & Bradstreet Canadian DMI System Tape Record.*
- Dun & Bradstreet telephone survey (see Survey form in Appendix B).

**Coding**

- This information was originally coded by Dun & Bradstreet for use in the SAS statistical analysis package. A complete listing of those results is available on request.
- No other coding applicable.

**EPI SOURCING DATABASE**

**Description**

- Information on approximately 1,700 firms in the Ontario Environment Protection Industry (EPI) including services provided.

**Source**

- Ministry of Industry, Trade and Technology. This database was developed as part of Woods Gordon's study of the EPI for the MOE.

**Coding**

- None applicable.
- This database is not in dBASE IV format. The file EPIREAD.ME provides installation and operation instructions. Four other files make up the database:
  - ONTARIO.BAT
  - ONTARIO.ZIP
  - PKZIP.EXE
  - PKUNZIP.EXE

### D.3.4 Coding Files

**CTYCODE.DBF AND MUNCODE.DBF**

**Source**

- Five digit codes for identifying county and municipality were taken from the *Municipal Directory*, 1989, published by the Ministry of Municipal Affairs.

**Coding**

- These files are used to print out county and municipality names, rather than five digit codes, by linking to the file with the information of interest.

## D.4. DATABASE UPDATING

The MSW database has no built-in updating capabilities. In other words, no special input or output screens have been developed to allow for tracking of the waste management system over time and no provision for including the date of any changes has been made. However, the .DBF files may be edited to bring information up-to-date. Documentation of any changes and any sources of new information would remain the responsibility of the database users.

It is important to note that updates to one database do not correct information in related databases. For example, if total amounts of ICI waste for some counties are adjusted in ICICTY89.DBF, the provincial totals will change. However, the province totals provided by ICICPT89.DBF will not automatically be adjusted, since this would involve a complex iterative procedure, as indicated by the discussion of Section 3.3.2. This is an important limitation of the MSW database, however, it should be noted that any calculated fields created under the Queries function as well as any reports would be automatically updated when data are adjusted.

Structure for database: C:\VOEMBA\AGENT1.DBF
Number of data records: 80
Date of last update : 11/07/90

| Field | Field Name | Type | Width | Dec | Index |
|---|---|---|---|---|---|
| 1 | AGENTNO | Numeric | 2 | | N |
| 2 | AGENTNAME | Character | 30 | | N |
| 3 | TYPE | Character | 1 | | N |
| 4 | ACTIVE87 | Logical | 1 | | N |
| 5 | ADDRESS | Character | 30 | | N |
| 6 | CITY | Character | 20 | | N |
| 7 | POSTALCODE | Character | 7 | | N |
| 8 | EMPLOYEE | Numeric | 4 | 1 | N |
| 9 | VOLUNTEER | Numeric | 4 | 1 | N |
| 10 | HANDICAP | Numeric | 4 | 1 | N |
| 11 | CONTACT | Character | 30 | | N |
| 12 | PHONE | Character | 13 | | N |
| 13 | COST1987 | Numeric | 7 | | N |
| 14 | OPER1988 | Numeric | 7 | | N |
| 15 | CAP1988 | Numeric | 7 | | N |
| 16 | OPER1989 | Numeric | 7 | | N |
| 17 | CAP1989 | Numeric | 7 | | N |
| 18 | MUN1 | Numeric | 7 | | N |
| 19 | MUN2 | Numeric | 7 | | N |
| 20 | MUN3 | Numeric | 7 | | N |
| 21 | MUN4 | Numeric | 7 | | N |
| 22 | MUN5 | Numeric | 7 | | N |
| 23 | MUN6 | Numeric | 7 | | N |
| 24 | MUN7 | Numeric | 7 | | N |
| 25 | MUN8 | Numeric | 7 | | N |
| 26 | MUN9 | Numeric | 7 | | N |
| 27 | MUN10 | Numeric | 7 | | N |
| 28 | MUN11 | Numeric | 7 | | N |
| 29 | MUN12 | Numeric | 7 | | N |
| 30 | MUN14 | Numeric | 7 | | N |
| 31 | MUN15 | Numeric | 7 | | N |
| 32 | MUN16 | Numeric | 7 | | N |
| 33 | MUN17 | Numeric | 7 | | N |
| 34 | MUN18 | Numeric | 7 | | N |
| 35 | MUN19 | Numeric | 7 | | N |
| 36 | MUN20 | Numeric | 7 | | N |
| 37 | MUN21 | Numeric | 7 | | N |
| ** Total ** | | | 322 | | |

Structure for database: C:\WOENSV\AGENT2.DBF
Number of data records: 295
Date of last update : 11/08/90

| Field | Field Name | Type | Width | Dec | Index |
|---|---|---|---|---|---|
| 1 | NAME | Character | 45 | | N |
| 2 | ADDRESS | Character | 35 | | N |
| 3 | CITY | Character | 25 | | N |
| 4 | POSTAL | Character | 7 | | N |
| 5 | PHONE | Character | 13 | | N |
| 6 | COUNTY | Character | 15 | | N |
| 7 | PAPER | Logical | 1 | | N |
| 8 | GLASS | Logical | 1 | | N |
| 9 | METAL | Logical | 1 | | N |
| 10 | PLASTIC | Logical | 1 | | N |
| 11 | BROKER | Logical | 1 | | N |
| 12 | DEALER | Logical | 1 | | N |
| 13 | DISPOSAL | Logical | 1 | | N |
| 14 | TRANSPORT | Logical | 1 | | N |
| 15 | IMPORTER | Logical | 1 | | N |
| 16 | MILL | Logical | 1 | | N |
| 17 | PACKER | Logical | 1 | | N |
| 18 | PROCESSOR | Logical | 1 | | N |
| 19 | TRANSFERS | Logical | 1 | | N |
| 20 | FERROUS | Logical | 1 | | N |
| 21 | NONFERROUS | Logical | 1 | | N |
| ** Total ** | | | 156 | | |

Structure for database: C:\NOEMSW\CTYCODE.DBF
Number of data records: 50
Date of last update : 06/27/90

| Field | Field Name | Type | Width | Dec | Index |
|---|---|---|---|---|---|
| 1 | CTYNAME | Character | 20 | | N |
| 2 | CTY | Numeric | 6 | | Y |
| ** Total ** | | | 27 | | |

Structure for database: C:\MOEHSW\EQUIP.DBF
Number of data records: 44
Date of last update : 08/15/90

| Field | Field Name | Type | Width | Dec | Index |
|---|---|---|---|---|---|
| 1 | COMPANY | Character | 35 | | N |
| 2 | STREET | Character | 35 | | N |
| 3 | CITY | Character | 20 | | N |
| 4 | POSTALCODE | Character | 7 | | N |
| 5 | PHONE | Character | 13 | | N |
| 6 | EQUIP1 | Character | 30 | | N |
| 7 | EQUIP2 | Character | 30 | | N |
| 8 | EQUIP3 | Character | 30 | | N |
| 9 | EQUIP4 | Character | 30 | | N |
| 10 | EQUIP5 | Character | 30 | | N |
| 11 | EQUIP6 | Character | 30 | | N |
| 12 | EQUIP7 | Character | 30 | | N |
| 13 | EQUIP8 | Character | 30 | | N |
| 14 | EQUIP9 | Character | 30 | | N |
| 15 | EQUIP10 | Character | 30 | | N |
| ** Total ** | | | 411 | | |

Structure for database: C:\VIENNA\HAULER.DBF
Number of data records: 123
Date of last update : 11/02/90

| Field | Field Name | Type | Width | Dec | Index |
|---|---|---|---|---|---|
| 1 | COMPANY | Character | 35 | | N |
| 2 | ADDRESS | Character | 30 | | N |
| 3 | CITY | Character | 20 | | N |
| 4 | COUNTY | Character | 20 | | N |
| 5 | POSTALCODE | Character | 7 | | N |
| 6 | PHONE | Character | 13 | | N |
| 7 | CONTACT | Character | 30 | | N |
| 8 | DOMESTIC | Logical | 1 | | N |
| 9 | INDCOMM | Logical | 1 | | N |
| 10 | LANDFILL | Logical | 1 | | N |
| 11 | TRANSFERS | Logical | 1 | | N |
| 12 | RECYCLING | Logical | 1 | | N |
| ** Total ** | | | 161 | | |

Structure for database: B:\ICICPT87.DBF
Number of data records: 10
Date of last update : 02/11/91

| Field | Field Name | Type | Width | Dec | Index |
|---|---|---|---|---|---|
| 1 | WASTETYPE | Character | 13 | | N |
| 2 | IMC1 | Numeric | 12 | | N |
| 3 | IMC2 | Numeric | 12 | | N |
| 4 | IMC3 | Numeric | 12 | | N |
| 5 | IMC4 | Numeric | 12 | | N |
| 6 | IMC5 | Numeric | 12 | | N |
| 7 | IMC6 | Numeric | 12 | | N |
| 8 | IMC7 | Numeric | 12 | | N |
| 9 | IMC8 | Numeric | 12 | | N |
| 10 | IMC9 | Numeric | 12 | | N |
| 11 | IMC10 | Numeric | 12 | | N |
| 12 | IMC11 | Numeric | 12 | | N |
| 13 | IMC12 | Numeric | 12 | | N |
| 14 | IMC13 | Numeric | 12 | | N |
| 15 | IMC14 | Numeric | 12 | | N |
| 16 | IMC15 | Numeric | 12 | | N |
| 17 | IMC16 | Numeric | 12 | | N |
| 18 | IMC17 | Numeric | 12 | | N |
| 19 | IMC18 | Numeric | 12 | | N |
| 20 | IMC19 | Numeric | 12 | | N |
| 21 | IMC20 | Numeric | 12 | | N |
| 22 | IMC21 | Numeric | 12 | | N |
| 23 | IMC22 | Numeric | 12 | | N |
| 24 | IMC23 | Numeric | 12 | | N |
| 25 | IMC24 | Numeric | 12 | | N |
| 26 | IMC25 | Numeric | 12 | | N |
| 27 | TOTAL | Numeric | 12 | | N |
| ** Total ** | | | 326 | | |

Structure for database: B:\ICICPT89.DBF
Number of data records: 10
Date of last update : 02/11/91

| Field | Field Name | Type | Width | Dec | Index |
|---|---|---|---|---|---|
| 1 | WASTETYPE | Character | 13 | | N |
| 2 | IMC1 | Numeric | 12 | | N |
| 3 | IMC2 | Numeric | 12 | | N |
| 4 | IMC3 | Numeric | 12 | | N |
| 5 | IMC4 | Numeric | 12 | | N |
| 6 | IMC5 | Numeric | 12 | | N |
| 7 | IMC6 | Numeric | 12 | | N |
| 8 | IMC7 | Numeric | 12 | | N |
| 9 | IMC8 | Numeric | 12 | | N |
| 10 | IMC9 | Numeric | 12 | | N |
| 11 | IMC10 | Numeric | 12 | | N |
| 12 | IMC11 | Numeric | 12 | | N |
| 13 | IMC12 | Numeric | 12 | | N |
| 14 | IMC13 | Numeric | 12 | | N |
| 15 | IMC14 | Numeric | 12 | | N |
| 16 | IMC15 | Numeric | 12 | | N |
| 17 | IMC16 | Numeric | 12 | | N |
| 18 | IMC17 | Numeric | 12 | | N |
| 19 | IMC18 | Numeric | 12 | | N |
| 20 | IMC19 | Numeric | 12 | | N |
| 21 | IMC20 | Numeric | 12 | | N |
| 22 | IMC21 | Numeric | 12 | | N |
| 23 | IMC22 | Numeric | 12 | | N |
| 24 | IMC23 | Numeric | 12 | | N |
| 25 | IMC24 | Numeric | 12 | | N |
| 26 | IMC25 | Numeric | 12 | | N |
| 27 | TOTAL | Numeric | 12 | | N |
| ** Total ** | | | 326 | | |

Structure for database: B:\ICICTY87.DBF
Number of data records: 44
Date of last update : 02/11/91

| Field | Field Name | Type | Width | Dec | Index |
|---|---|---|---|---|---|
| 1 | COUNTY1 | Numeric | 5 | | N |
| 2 | COUNTY2 | Numeric | 5 | | N |
| 3 | COUNTY3 | Numeric | 5 | | N |
| 4 | COUNTY4 | Numeric | 5 | | N |
| 5 | IMC1 | Numeric | 12 | | N |
| 6 | IMC2 | Numeric | 12 | | N |
| 7 | IMC3 | Numeric | 12 | | N |
| 8 | IMC4 | Numeric | 12 | | N |
| 9 | IMC5 | Numeric | 12 | | N |
| 10 | IMC6 | Numeric | 12 | | N |
| 11 | IMC7 | Numeric | 12 | | N |
| 12 | IMC8 | Numeric | 12 | | N |
| 13 | IMC9 | Numeric | 12 | | N |
| 14 | IMC10 | Numeric | 12 | | N |
| 15 | IMC11 | Numeric | 12 | | N |
| 16 | IMC12 | Numeric | 12 | | N |
| 17 | IMC13 | Numeric | 12 | | N |
| 18 | IMC14 | Numeric | 12 | | N |
| 19 | IMC15 | Numeric | 12 | | N |
| 20 | IMC16 | Numeric | 12 | | N |
| 21 | IMC17 | Numeric | 12 | | N |
| 22 | IMC18 | Numeric | 12 | | N |
| 23 | IMC19 | Numeric | 12 | | N |
| 24 | IMC20 | Numeric | 12 | | N |
| 25 | IMC21 | Numeric | 12 | | N |
| 26 | IMC22 | Numeric | 12 | | N |
| 27 | IMC23 | Numeric | 12 | | N |
| 28 | IMC24 | Numeric | 12 | | N |
| 29 | IMC25 | Numeric | 12 | | N |
| 30 | TOTAL | Numeric | 12 | | N |
| ** Total ** | | | 333 | | |

Structure for database: C:\MOENSH\LANDFILL.DBF
Number of data records: 730
Date of last update : 11/13/90

| Field | Field Name | Type | Width | Dec | Index |
|---|---|---|---|---|---|
| 1 | COUNTY | Numeric | 9 | | N |
| 2 | CERTHOLD | Character | 30 | | N |
| 3 | STREET1 | Character | 30 | | N |
| 4 | CITY1 | Character | 15 | | N |
| 5 | OPERATOR | Character | 30 | | N |
| 6 | STREET2 | Character | 30 | | N |
| 7 | CITY2 | Character | 15 | | N |
| 8 | POSTCODE1 | Character | 7 | | N |
| 9 | POSTCODE2 | Character | 7 | | N |
| 10 | PHONE | Character | 13 | | N |
| 11 | SITELOC | Numeric | 9 | | N |
| 12 | CONCESS | Character | 8 | | N |
| 13 | LOTNO | Character | 10 | | N |
| 14 | NTS | Character | 7 | | N |
| 15 | TONNAGE | Numeric | 8 | | N |
| 16 | MUN1 | Character | 9 | | N |
| 17 | POP1 | Numeric | 8 | | N |
| 18 | MUN2 | Numeric | 9 | | N |
| 19 | POP2 | Numeric | 8 | | N |
| 20 | MUN3 | Numeric | 9 | | N |
| 21 | POP3 | Numeric | 8 | | N |
| 22 | MUN4 | Numeric | 9 | | N |
| 23 | POP4 | Numeric | 8 | | N |
| 24 | MUN5 | Numeric | 9 | | N |
| 25 | POP5 | Numeric | 8 | | N |
| 26 | MUN6 | Numeric | 9 | | N |
| 27 | POP6 | Numeric | 8 | | N |
| 28 | MUN7 | Numeric | 9 | | N |
| 29 | POP7 | Numeric | 8 | | N |
| 30 | MUN8 | Numeric | 9 | | N |
| 31 | POP8 | Numeric | 8 | | N |
| 32 | MUN9 | Numeric | 9 | | N |
| 33 | POP9 | Numeric | 8 | | N |
| 34 | MUN10 | Numeric | 9 | | N |
| 35 | POP10 | Numeric | 8 | | N |
| 36 | LIFE | Numeric | 2 | | N |
| 37 | STARTDATE | Numeric | 4 | | N |
| 38 | DOMESTIC | Numeric | 7 | | N |
| 39 | COMMERCIAL | Numeric | 7 | | N |
| 40 | NONHAZ | Numeric | 7 | | N |
| 41 | REMLIFE | Numeric | 5 | 1 | N |
| 42 | AREA | Character | 10 | | N |
| 43 | WASTESOURC | Character | 7 | | N |
| 44 | RESWASTE | Logical | 1 | | N |
| 45 | ICIWASTE | Logical | 1 | | N |
| 46 | CAPITAL | Numeric | 10 | | N |
| 47 | OPERATING | Numeric | 10 | | N |
| 48 | FULL | Numeric | 2 | | N |
| 49 | PART | Numeric | 2 | | N |
| 50 | TIPB9 | Character | 12 | | N |
| ** Total ** | | | 486 | | |

Structure for database: C:\WOENSW\WRF.DBF
Number of data records: 15
Date of last update : 11/15/90

| Field | Field Name | Type | Width | Dec | Index |
|---|---|---|---|---|---|
| 1 | COUNTY | Numeric | 5 | | N |
| 2 | MUN | Numeric | 5 | | N |
| 3 | AGENTNO | Numeric | 3 | | N |
| 4 | NAME | Character | 30 | | N |
| 5 | POSITION | Character | 30 | | N |
| 6 | FACILITY | Character | 30 | | N |
| 7 | ADDRESS | Character | 30 | | N |
| 8 | CITY | Character | 30 | | N |
| 9 | PHONE | Character | 13 | | N |
| 10 | FULL | Numeric | 2 | | N |
| 11 | PART | Numeric | 2 | | N |
| 12 | CAPITAL | Character | 10 | | N |
| 13 | OPERATING | Character | 10 | | N |
| 14 | ACTIVITY1 | Character | 25 | | N |
| 15 | ACTIVITY2 | Character | 25 | | N |
| 16 | ACTIVITY3 | Character | 25 | | N |
| 17 | ACTIVITY4 | Character | 25 | | N |
| 18 | ACTIVITY5 | Character | 25 | | N |
| 19 | ACTIVITY6 | Character | 25 | | N |
| 20 | ACTIVITY7 | Character | 25 | | N |
| 21 | WASTESOURC | Character | 7 | | N |
| 22 | RESWASTE | Logical | 1 | | N |
| 23 | ICIWASTE | Logical | 1 | | N |
| 24 | PACP | Logical | 1 | | N |
| 25 | PAOCC | Logical | 1 | | N |
| 26 | CD | Logical | 1 | | N |
| 27 | GLFB | Logical | 1 | | N |
| 28 | HHW | Logical | 1 | | N |
| 29 | ALFL | Logical | 1 | | N |
| 30 | ALFB | Logical | 1 | | N |
| 31 | TSFB | Logical | 1 | | N |
| 32 | PAMAGMIX | Logical | 1 | | N |
| 33 | PATB | Logical | 1 | | N |
| 34 | PANP | Logical | 1 | | N |
| 35 | PAFP | Logical | 1 | | N |
| 36 | PABB | Logical | 1 | | N |
| 37 | PLR | Logical | 1 | | N |
| 38 | PLF | Logical | 1 | | N |
| 39 | DIAP | Logical | 1 | | N |
| 40 | YW | Logical | 1 | | N |
| 41 | WW | Logical | 1 | | N |
| 42 | UT | Logical | 1 | | N |
| 43 | TSMG | Logical | 1 | | N |
| 44 | FW | Logical | 1 | | N |
| 45 | CODW | Logical | 1 | | N |
| 46 | MUN1 | Numeric | 5 | | N |
| 47 | MUN2 | Numeric | 5 | | N |
| 48 | MUN3 | Numeric | 5 | | N |
| 49 | MUN4 | Numeric | 5 | | N |
| 50 | MUN5 | Numeric | 5 | | N |
| 51 | MUN6 | Numeric | 5 | | N |
| 52 | MUN7 | Numeric | 5 | | N |
| 53 | MUN8 | Numeric | 5 | | N |
| 54 | MUN9 | Numeric | 5 | | N |
| 55 | MUN10 | Numeric | 5 | | N |
| 56 | MUN11 | Numeric | 5 | | N |
| 57 | MUN12 | Numeric | 5 | | N |
| 58 | MUN13 | Numeric | 5 | | N |
| 59 | MUN14 | Numeric | 5 | | N |

| | | | | |
|---|---|---|---|---|
| 60 | MUN15 | Numeric | 5 | N |
| ** Total ** | | | 482 | |

Page # 1

Structure for database: C:\WOEKSW\MUNCODE.DBF
Number of data records: 1003
Date of last update : 07/23/90

| Field | Field Name | Type | Width | Dec | Index |
|---|---|---|---|---|---|
| 1 | MUNNAME | Character | 30 | | N |
| 2 | MUN | Numeric | 6 | | Y |
| 3 | POP | Numeric | 9 | | N |
| ** Total ** | | | 46 | | |

Structure for database: C:\KOENSV\RECYCLE.DBF
Number of data records: 46
Date of last update : 11/05/90

| Field | Field Name | Type | Width | Dec | Index |
|---|---|---|---|---|---|
| 1 | CTY | Numeric | 5 | | N |
| 2 | MUN | Numeric | 5 | | N |
| 3 | AGENTNO | Numeric | 2 | | Y |
| 4 | CONTACT | Character | 30 | | N |
| 5 | PROGTYPE | Character | 2 | | N |
| 6 | BBOXPROG | Logical | 1 | | N |
| 7 | DEPOTPROG | Logical | 1 | | N |
| 8 | BLUEBOX | Numeric | 12 | | N |
| 9 | PANP1987 | Numeric | 10 | | N |
| 10 | GLAS1987 | Numeric | 10 | | N |
| 11 | TIN1987 | Numeric | 10 | | N |
| 12 | ALUM1987 | Numeric | 10 | | N |
| 13 | TOTAL1987 | Numeric | 10 | | N |
| 14 | PANP1989 | Numeric | 10 | | N |
| 15 | GLAS1989 | Numeric | 10 | | N |
| 16 | TIN1989 | Numeric | 10 | | N |
| 17 | ALUM1989 | Numeric | 10 | | N |
| 18 | PET1989 | Numeric | 10 | | N |
| 19 | TOTAL1989 | Numeric | 10 | | N |
| 20 | COST1987 | Numeric | 11 | | N |
| 21 | OPER1988 | Numeric | 11 | | N |
| 22 | CAP1988 | Numeric | 11 | | N |
| 23 | OPER1989 | Numeric | 11 | | N |
| 24 | CAP1989 | Numeric | 11 | | N |
| ** Total ** | | | 224 | | |

Structure for database: C:\MOENSW\RESCON87.DBF
Number of data records: 1
Date of last update : 10/25/90

| Field | Field Name | Type | Width | Dec | Index |
|---|---|---|---|---|---|
| 1 | CONP87 | Numeric | 4 | | Y |
| 2 | PANP | Numeric | 9 | 4 | N |
| 3 | PAFP | Numeric | 9 | 4 | N |
| 4 | PABB | Numeric | 9 | 4 | N |
| 5 | PAOCC | Numeric | 9 | 4 | N |
| 6 | PAMAG | Numeric | 9 | 4 | N |
| 7 | PAMIX | Numeric | 9 | 4 | N |
| 8 | PATB | Numeric | 9 | 4 | N |
| 9 | PACP | Numeric | 9 | 4 | N |
| 10 | PAOTH | Numeric | 9 | 4 | N |
| 11 | GLFB | Numeric | 9 | 4 | N |
| 12 | GLOTH | Numeric | 9 | 4 | N |
| 13 | TSFB | Numeric | 9 | 4 | N |
| 14 | TSWG | Numeric | 9 | 4 | N |
| 15 | TSOTH | Numeric | 9 | 4 | N |
| 16 | ALFB | Numeric | 9 | 4 | N |
| 17 | ALOC | Numeric | 9 | 4 | N |
| 18 | ALFL | Numeric | 9 | 4 | N |
| 19 | ALOTH | Numeric | 9 | 4 | N |
| 20 | PLND | Numeric | 9 | 4 | N |
| 21 | PLPET | Numeric | 9 | 4 | N |
| 22 | PLR | Numeric | 9 | 4 | N |
| 23 | PLF | Numeric | 9 | 4 | N |
| 24 | FW | Numeric | 9 | 4 | N |
| 25 | YWLGW | Numeric | 9 | 4 | N |
| 26 | YWOTH | Numeric | 9 | 4 | N |
| 27 | WW | Numeric | 9 | 4 | N |
| 28 | CD | Numeric | 9 | 4 | N |
| 29 | CDOTH | Numeric | 9 | 4 | N |
| 30 | DIAP | Numeric | 9 | 4 | N |
| 31 | UT | Numeric | 9 | 4 | N |
| 32 | HHW | Numeric | 9 | 4 | N |
| 33 | OTH | Numeric | 9 | 4 | N |
| ** Total ** | | | 293 | | |

Structure for database: C:\WOEMSW\RESCOM89.DBF
Number of data records: 1
Date of last update : 09/20/90

| Field | Field Name | Type | Width | Dec | Index |
|---|---|---|---|---|---|
| 1 | COMP89 | Numeric | 4 | | Y |
| 2 | PANP | Numeric | 9 | 4 | N |
| 3 | PAFP | Numeric | 9 | 4 | N |
| 4 | PABB | Numeric | 9 | 4 | N |
| 5 | PAOCC | Numeric | 9 | 4 | N |
| 6 | PAMAG | Numeric | 9 | 4 | N |
| 7 | PAMIX | Numeric | 9 | 4 | N |
| 8 | PATB | Numeric | 9 | 4 | N |
| 9 | PACP | Numeric | 9 | 4 | N |
| 10 | PAOTH | Numeric | 9 | 4 | N |
| 11 | GLFB | Numeric | 9 | 4 | N |
| 12 | GLOTH | Numeric | 9 | 4 | N |
| 13 | TSFB | Numeric | 9 | 4 | N |
| 14 | TSMG | Numeric | 9 | 4 | N |
| 15 | TSOTH | Numeric | 9 | 4 | N |
| 16 | ALFB | Numeric | 9 | 4 | N |
| 17 | ALOC | Numeric | 9 | 4 | N |
| 18 | ALFL | Numeric | 9 | 4 | N |
| 19 | ALOTH | Numeric | 9 | 4 | N |
| 20 | PLND | Numeric | 9 | 4 | N |
| 21 | PLPET | Numeric | 9 | 4 | N |
| 22 | PLR | Numeric | 9 | 4 | N |
| 23 | PLF | Numeric | 9 | 4 | N |
| 24 | FW | Numeric | 9 | 4 | N |
| 25 | YWLGW | Numeric | 9 | 4 | N |
| 26 | YWOTH | Numeric | 9 | 4 | N |
| 27 | WW | Numeric | 9 | 4 | N |
| 28 | CD | Numeric | 9 | 4 | N |
| 29 | CDOTH | Numeric | 9 | 4 | N |
| 30 | DIAP | Numeric | 9 | 4 | N |
| 31 | UT | Numeric | 9 | 4 | N |
| 32 | HHW | Numeric | 9 | 4 | N |
| 33 | OTH | Numeric | 9 | 4 | N |
| ** Total ** | | | 293 | | |

Structure for database: C:\WOEHSW\RESIDENT.DBF
Number of data records: 796
Date of last update : 11/09/90

| Field | Field Name | Type | Width | Dec | Index |
|---|---|---|---|---|---|
| 1 | CNT | Character | 20 | | N |
| 2 | CTY | Numeric | 6 | | N |
| 3 | MUN | Numeric | 6 | | N |
| 4 | POP87 | Numeric | 9 | | N |
| 5 | POP89 | Numeric | 9 | | N |
| 6 | RESGEN87 | Numeric | 7 | 3 | N |
| 7 | RESGEN89 | Numeric | 7 | 3 | N |
| 8 | RES87 | Numeric | 13 | 2 | N |
| 9 | RES89 | Numeric | 13 | 2 | N |
| 10 | ASSUMRES | Logical | 1 | | N |
| 11 | COMP87 | Numeric | 4 | | N |
| 12 | COMP89 | Numeric | 4 | | N |
| ** Total ** | | | 100 | | |

Structure for database: C:\MOEMSW\SIC49538.DBF
Number of data records: 65
Date of last update : 11/18/90

| Field | Field Name | Type | Width | Dec | Index |
|---|---|---|---|---|---|
| 1 | DUNSNUM | Numeric | 9 | | N |
| 2 | NATCODE | Numeric | 3 | | N |
| 3 | COUNTRYCD | Numeric | 3 | | N |
| 4 | PROVINCECD | Numeric | 2 | | N |
| 5 | CITYCODE | Numeric | 4 | | N |
| 6 | BLANK1 | Numeric | 1 | | N |
| 7 | BUSNAME | Character | 30 | | N |
| 8 | STREETADD | Character | 25 | | N |
| 9 | MAILADD | Character | 22 | | N |
| 10 | CITYNAME | Character | 13 | | N |
| 11 | PROVINCENM | Character | 2 | | N |
| 12 | BLANK2 | Numeric | 2 | | N |
| 13 | POSTALCODE | Character | 7 | | N |
| 14 | TELEPHONE | Numeric | 12 | | N |
| 15 | CEO | Character | 19 | | N |
| 16 | BUSTYPE | Character | 19 | | N |
| 17 | STARTYEAR | Numeric | 4 | | N |
| 18 | ZEROES1 | Numeric | 7 | | N |
| 19 | SALESFIG | Numeric | 12 | | N |
| 20 | ZEROES2 | Numeric | 5 | | N |
| 21 | EMPLHERE | Numeric | 6 | | N |
| 22 | EMPLTOTAL | Numeric | 6 | | N |
| 23 | SIC1 | Numeric | 4 | | N |
| 24 | SIC2 | Numeric | 4 | | N |
| 25 | SIC3 | Numeric | 4 | | N |
| 26 | SIC4 | Numeric | 4 | | N |
| 27 | SIC5 | Numeric | 4 | | N |
| 28 | SIC6 | Numeric | 4 | | N |
| 29 | SECNAME | Character | 30 | | N |
| 30 | HDQTCITY | Character | 13 | | N |
| 31 | HDQTPROV | Character | 4 | | N |
| 32 | HDQTOFFICE | Character | 3 | | N |
| 33 | HDQTDUNSNO | Numeric | 9 | | N |
| 34 | PARDUNSNO | Numeric | 9 | | N |
| 35 | ULTDUNSNO | Numeric | 9 | | N |
| 36 | STATUS | Numeric | 2 | | N |
| 37 | SUBSIDIARY | Character | 1 | | N |
| 38 | MANIND | Character | 1 | | N |
| 39 | LANGIND | Character | 1 | | N |
| 40 | FILLER | Character | 4 | | N |
| 41 | MDGCODE | Numeric | 4 | | N |
| 42 | SMSACODE | Numeric | 3 | | N |
| 43 | CDNSIC1 | Numeric | 4 | | N |
| 44 | CDNSIC2 | Numeric | 4 | | N |
| 45 | CDNSIC3 | Numeric | 4 | | N |
| 46 | CDNSIC4 | Numeric | 4 | | N |
| 47 | FILLER2 | Numeric | 5 | | N |
| 48 | DBREPOFF | Numeric | 3 | | N |
| 49 | TRANSCODE | Numeric | 1 | | N |
| 50 | REASONCODE | Numeric | 2 | | N |
| 51 | TRANSDATE | Numeric | 6 | | N |
| 52 | NUMBER | Numeric | 3 | | N |
| 53 | DUNSNUMBER | Numeric | 9 | | N |
| 54 | Q1AI | Numeric | 1 | | N |
| 55 | Q1AII | Numeric | 1 | | N |
| 56 | Q1AIII | Numeric | 1 | | N |
| 57 | Q1BI | Numeric | 3 | | N |
| 58 | Q1BII | Numeric | 3 | | N |
| 59 | Q1BIII | Numeric | 3 | | N |

| | | | | |
|---|---|---|---|---|
| 60 | Q2 | Numeric | 3 | N |
| 61 | Q3 | Numeric | 1 | N |
| 62 | Q4 | Numeric | 1 | N |
| 63 | Q5 | Numeric | 1 | N |
| 64 | Q6 | Numeric | 8 | N |
| 65 | Q7 | Numeric | 8 | N |
| 66 | Q8I | Numeric | 2 | N |
| 67 | Q8II | Numeric | 2 | N |
| 68 | Q8III | Numeric | 2 | N |
| 69 | Q8IV | Numeric | 2 | N |
| 70 | Q8V | Numeric | 2 | N |
| 71 | Q8VI | Numeric | 2 | N |
| 72 | Q8VII | Numeric | 2 | N |
| 73 | Q8VIII | Numeric | 2 | N |
| 74 | Q8IX | Numeric | 2 | N |
| 75 | Q8X | Numeric | 2 | N |
| 76 | Q9AI | Numeric | 3 | N |
| 77 | Q9AII | Numeric | 3 | N |
| 78 | Q9AIII | Numeric | 3 | N |
| 79 | Q9BIC | Numeric | 1 | N |
| 80 | Q9BID | Numeric | 6 | N |
| 81 | Q9BIIC | Numeric | 1 | N |
| 82 | Q9BIID | Numeric | 6 | N |
| 83 | Q9BIIIC | Numeric | 1 | N |
| 84 | Q9BIIID | Numeric | 6 | N |
| 85 | Q10I | Numeric | 3 | N |
| 86 | Q10II | Numeric | 3 | N |
| 87 | Q10III | Numeric | 3 | N |
| 88 | Q11A1Y | Numeric | 1 | N |
| 89 | Q11A1F | Numeric | 1 | N |
| 90 | Q11A1T | Numeric | 1 | N |
| 91 | Q11A1G | Numeric | 1 | N |
| 92 | Q11A2Y | Numeric | 1 | N |
| 93 | Q11A2F | Numeric | 1 | N |
| 94 | Q11A2T | Numeric | 1 | N |
| 95 | Q11A2G | Numeric | 1 | N |
| 96 | Q11A3Y | Numeric | 1 | N |
| 97 | Q11A3F | Numeric | 1 | N |
| 98 | Q11A3T | Numeric | 1 | N |
| 99 | Q11A3G | Numeric | 1 | N |
| 100 | Q11A4Y | Numeric | 1 | N |
| 101 | Q11A4F | Numeric | 1 | N |
| 102 | Q11A4T | Numeric | 1 | N |
| 103 | Q11A4G | Numeric | 1 | N |
| 104 | Q11A5Y | Numeric | 1 | N |
| 105 | Q11A5F | Numeric | 1 | N |
| 106 | Q11A5T | Numeric | 1 | N |
| 107 | Q11A5G | Numeric | 1 | N |
| 108 | Q11A6Y | Numeric | 1 | N |
| 109 | Q11A6F | Numeric | 1 | N |
| 110 | Q11A6T | Numeric | 1 | N |
| 111 | Q11A6G | Numeric | 1 | N |
| 112 | Q11A7Y | Numeric | 1 | N |
| 113 | Q11A7F | Numeric | 1 | N |
| 114 | Q11A7T | Numeric | 1 | N |
| 115 | Q11A7G | Numeric | 1 | N |
| 116 | Q11BI | Numeric | 3 | N |
| 117 | Q11BII | Numeric | 3 | N |
| 118 | Q11BIII | Numeric | 3 | N |
| 119 | Q11BIV | Numeric | 3 | N |
| 120 | Q11BV | Numeric | 3 | N |
| 121 | Q11BVI | Numeric | 3 | N |
| 122 | Q11BVII | Numeric | 3 | N |
| 123 | Q12 | Numeric | 1 | N |

| | | | | |
|---|---|---|---|---|
| 124 | Q13I | Numeric | 3 | N |
| 125 | Q13II | Numeric | 3 | N |
| 126 | Q13III | Numeric | 3 | N |
| 127 | Q14AI | Numeric | 3 | N |
| 128 | Q14AII | Numeric | 3 | N |
| 129 | Q14AIII | Numeric | 3 | N |
| 130 | Q14AIV | Numeric | 3 | N |
| 131 | Q14AV | Numeric | 3 | N |
| 132 | Q14AVI | Numeric | 3 | N |
| 133 | Q14AVII | Numeric | 3 | N |
| 134 | Q14AVIII | Numeric | 3 | N |
| 135 | Q14AIX | Numeric | 3 | N |
| 136 | Q14AX | Numeric | 3 | N |
| 137 | Q14AXI | Numeric | 3 | N |
| 138 | Q14AXII | Numeric | 3 | N |
| 139 | Q14AXIII | Numeric | 3 | N |
| 140 | Q14BIC | Numeric | 1 | N |
| 141 | Q14BIIC | Numeric | 1 | N |
| 142 | Q14BIIIC | Numeric | 1 | N |
| 143 | Q14BIVC | Numeric | 1 | N |
| 144 | Q14BVC | Numeric | 1 | N |
| 145 | Q14BVIC | Numeric | 1 | N |
| 146 | Q14BVIIC | Numeric | 1 | N |
| 147 | Q14BVIIIC | Numeric | 1 | N |
| 148 | Q14BIXC | Numeric | 1 | N |
| 149 | Q14BXC | Numeric | 1 | N |
| 150 | Q14BXIC | Numeric | 1 | N |
| 151 | Q14BXIIC | Numeric | 1 | N |
| 152 | Q14BXIIIC | Numeric | 1 | N |
| 153 | Q14BID | Numeric | 6 | N |
| 154 | Q14BIID | Numeric | 6 | N |
| 155 | Q14BIIID | Numeric | 6 | N |
| 156 | Q14BIVD | Numeric | 6 | N |
| 157 | Q14BVD | Numeric | 6 | N |
| 158 | Q14BVID | Numeric | 6 | N |
| 159 | Q14BVIID | Numeric | 6 | N |
| 160 | Q14BVIIID | Numeric | 6 | N |
| 161 | Q14BIXD | Numeric | 6 | N |
| 162 | Q14BXD | Numeric | 6 | N |
| 163 | Q14BXID | Numeric | 6 | N |
| 164 | Q14BXIID | Numeric | 6 | N |
| 165 | Q14BXIIID | Numeric | 6 | N |
| 166 | Q15I | Numeric | 2 | N |
| 167 | Q15II | Numeric | 2 | N |
| 168 | Q15III | Numeric | 2 | N |
| 169 | Q15IV | Numeric | 2 | N |
| 170 | Q15V | Numeric | 2 | N |
| 171 | Q15VI | Numeric | 2 | N |
| 172 | Q15VII | Numeric | 2 | N |
| 173 | Q15VIII | Numeric | 2 | N |
| 174 | Q15IX | Numeric | 2 | N |
| 175 | Q15X | Numeric | 2 | N |
| 176 | Q15XI | Numeric | 2 | N |
| 177 | Q16AI | Numeric | 3 | N |
| 178 | Q16AII | Numeric | 3 | N |
| 179 | Q16AIII | Numeric | 3 | N |
| 180 | Q16AIV | Numeric | 3 | N |
| 181 | Q16AV | Numeric | 3 | N |
| 182 | Q16AVI | Numeric | 3 | N |
| 183 | Q16AVII | Numeric | 3 | N |
| 184 | Q16AVIII | Numeric | 3 | N |
| 185 | Q16AIX | Numeric | 3 | N |
| 186 | Q16BI | Numeric | 1 | N |
| 187 | Q16BII | Numeric | 1 | N |

| | | | | |
|---|---|---|---|---|
| 188 | Q16BIII | Numeric | 1 | N |
| 189 | Q16BIV | Numeric | 1 | N |
| 190 | Q16BV | Numeric | 1 | N |
| 191 | Q16BVI | Numeric | 1 | N |
| 192 | Q16BVII | Numeric | 1 | N |
| 193 | Q16BVIII | Numeric | 1 | N |
| 194 | Q16BIX | Numeric | 1 | N |
| 195 | FIRST | Character | 15 | N |
| 196 | LAST | Character | 15 | N |
| 197 | TITLE | Character | 15 | N |
| ** Total ** | | | 761 | |

Structure for database: C:\KOENBA\SIC5093.DBF
Number of data records: 285
Date of last update : 11/20/90

| Field | Field Name | Type | Width | Dec | Index |
|---|---|---|---|---|---|
| 1 | DUNSNUM | Numeric | 9 | | N |
| 2 | NATCODE | Numeric | 3 | | N |
| 3 | COUNTRYCD | Numeric | 3 | | N |
| 4 | PROVINCECD | Numeric | 2 | | N |
| 5 | CITYCODE | Numeric | 4 | | N |
| 6 | BLANK1 | Numeric | 1 | | N |
| 7 | BUSNAME | Character | 30 | | N |
| 8 | STREETADD | Character | 25 | | N |
| 9 | MAILADD | Character | 22 | | N |
| 10 | CITYNAME | Character | 13 | | N |
| 11 | PROVINCENM | Character | 2 | | N |
| 12 | BLANK2 | Numeric | 2 | | N |
| 13 | POSTALCODE | Character | 7 | | N |
| 14 | TELEPHONE | Numeric | 10 | | N |
| 15 | CEO | Character | 19 | | N |
| 16 | BUSTYPE | Character | 19 | | N |
| 17 | STARTYEAR | Numeric | 4 | | N |
| 18 | ZEROES1 | Numeric | 7 | | N |
| 19 | SALESFIG | Numeric | 12 | | N |
| 20 | ZEROES2 | Numeric | 5 | | N |
| 21 | EMPLHERE | Numeric | 6 | | N |
| 22 | EMPLTOTAL | Numeric | 6 | | N |
| 23 | SIC1 | Numeric | 4 | | N |
| 24 | SIC2 | Numeric | 4 | | N |
| 25 | SIC3 | Numeric | 4 | | N |
| 26 | SIC4 | Numeric | 4 | | N |
| 27 | SIC5 | Numeric | 4 | | N |
| 28 | SIC6 | Numeric | 4 | | N |
| 29 | SECNAME | Character | 30 | | N |
| 30 | HDQTCITY | Character | 13 | | N |
| 31 | HDQTPROV | Character | 4 | | N |
| 32 | HDQTOFFICE | Character | 3 | | N |
| 33 | HDQTDUNSNO | Numeric | 9 | | N |
| 34 | PARDUNSNO | Numeric | 9 | | N |
| 35 | ULTDUNSNO | Numeric | 9 | | N |
| 36 | STATUS | Numeric | 2 | | N |
| 37 | SUBSIDIARY | Character | 1 | | N |
| 38 | MANIND | Character | 1 | | N |
| 39 | LANGIND | Character | 1 | | N |
| 40 | FILLER | Character | 4 | | N |
| 41 | HDQCODE | Numeric | 4 | | N |
| 42 | SMSACODE | Numeric | 3 | | N |
| 43 | CDNSIC1 | Numeric | 4 | | N |
| 44 | CDNSIC2 | Numeric | 4 | | N |
| 45 | CDNSIC3 | Numeric | 4 | | N |
| 46 | CDNSIC4 | Numeric | 4 | | N |
| 47 | FILLER2 | Numeric | 5 | | N |
| 48 | DBREPOFF | Numeric | 3 | | N |
| 49 | TRANSCODE | Numeric | 1 | | N |
| 50 | REASONCODE | Numeric | 2 | | N |
| 51 | TRANSDATE | Numeric | 6 | | N |
| ** Total ** | | | 362 | | |

Structure for database: C:\WDENSU\TRANSFER.DBF
Number of data records: 29
Date of last update : 10/01/90

| Field | Field Name | Type | Width | Dec | Index |
|---|---|---|---|---|---|
| 1 | COUNTY | Numeric | 5 | | N |
| 2 | OPERATOR | Character | 20 | | N |
| 3 | RUN1 | Character | 5 | | N |
| 4 | RUN2 | Character | 5 | | N |
| 5 | RUN3 | Character | 5 | | N |
| 6 | RUN4 | Character | 5 | | N |
| 7 | LOCATION | Numeric | 5 | | N |
| 8 | DESTINATN | Character | 15 | | N |
| 9 | WASTE | Character | 7 | | N |
| 10 | TIPFEE | Character | 5 | | N |
| ** Total ** | | | 78 | | |